# Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program

JANUARY 1983

IN REPLY REFER TO

# United States Department of the Interior

3500(162)

**BUREAU OF LAND MANAGEMENT**
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NOTICE

This is the Final Supplemental Environmental Impact Statement (EIS) for the Prototype Oil Shale Leasing Program. It includes changes made as a result of public comments on the Draft EIS.

The Final EIS is a full reprint of the Draft EIS. It includes copies of the comment letters received from the public, transcripts of the public hearings on the Draft EIS, and responses to the comments.

The preferred alternative identified in this Final EIS is to lease only Tract C-11. However, this is not the decision document. The decision on whether or not to lease one or two additional tracts under the prototype oil shale program will be made by the Secretary of Interior. That decision will be taken based on the information provided in this Final EIS, public concerns and comments, the recommendations of the Regional Oil Shale Team, and other resource management considerations. No action will be taken for at least 30 days following filing of the Final EIS with the Environmental Protection Agency and distribution to the public.

State Director

# FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM



Prepared by

BUREAU OF LAND MANAGEMENT

U.S.DEPARTMENT OF THE INTERIOR

George C. Francis

STATE DIRECTOR

COLORADO STATE OFFICE

# SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

## for the

# PROTOTYPE OIL SHALE LEASING PROGRAM

Draft ( ) Final (X)

The United States Department of the Interior, Bureau of Land Management

1. *Type of Action*: Administrative (X) Legislative ( )

2. *Abstract*: The Secretary of the Interior proposes to offer for lease one or two additional prototype oil shale leases in the Piceance Basin, northwestern Colorado to supplement the Department's existing prototype oil shale leasing program. The environmental and socioeconomic impacts of the following alternatives are analyzed in this EIS: leasing Tract C-11 only, leasing Tract C-18 only, leasing both Tract C-11 and C-18 (Combined Alternative), and a No Action Alternative. This document supplements the *1973 Prototype EIS*. If leased, the additional tract(s) would provide the opportunity for the extraction of oil shale concurrently with associated minerals, as well as for development of other appropriate technologies, more completely fulfilling the original goals of the prototype program. The impact analysis shows that, generally, most adverse impacts reach significance when compounded by developing two leases. The preferred alternative is to lease only Tract C-11.

3. The draft environmental impact statement received a 60 day public review. Comments received during this review period have been incorporated into the analysis contained in this final environmental impact statement. Comments were received from various individuals, organizations and governmental agencies and are displayed in Part 2 of this document.

4. *For further information, contact*:

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5. *Date Statement made available to EPA and to the public*:

**Draft** - July 16, 1982

**Final** - January 28, 1983

# DISTRIBUTION LIST

## FEDERAL AGENCIES

Department of Agriculture
Department of the Army Corps of Engineers
Department of Energy
Department of Interior
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- Minerals Management Service
- Bureau of Mines
- Bureau of Reclmation
- Office of Surface Mining
- Bureau of Indian Affairs
- National Park Service-Denver

Department of Labor
- Mine Safety & Health Administration

Department of Transportation
Environmental Protection Agency

## STATE AGENCY

Colorado Department of Education
Colorado Department of Health
Colorado Department of Natural Resources
Colorado Department of Social Services
Colorado Office of Energy Conservation
Colorado State Historic Preservation Office
Colorado State Clearinghouse

## LOCAL AGENCIES

Town, County Government Councils & Commissions
- Rifle
- Meeker
- Rangely
- Grand Junction
- Rio Blanco
- Garfield
- Mesa
- Moffat

Western Rio Blanco Parks and Recreation District
Eastern Rio Blanco Metropolitan Recreation and Parks District
Associated Governments of Northwest Colorado

## OTHER ORGANIZATIONS AND INDIVIDUALS

Numerous organizations and individuals expressing interest in the proposed action have been sent copies of this statement and have been invited to comment.

# TABLE OF CONTENTS

# PART 1

## FINAL

## ENVIRONMENTAL IMPACT STATEMENT

# PREFACE

This Final Environmental Impact Statement (EIS) is a full reprint of the Draft EIS, incorporating numerous changes and corrections that resulted from comments on the Draft. Part 1 is the Final EIS itself, and includes the proposed prototype oil shale lease in Appendix A. Part 2 includes copies of the letters commenting on the Draft EIS, the transcripts of the oral testimony given at the public hearings on the Draft EIS held in August 1982, and responses to those comments.

## Significant Differences Between the Draft and Final

In most cases, comments required corrections or clarifications to the text. These changes have been made and generally did not significantly alter the analysis, but simply clarified it for the reader. In other cases, the analysis has been expanded to add new information that was either not available at the time the Draft EIS was published, or that was provided by commenters on the Draft EIS. The following are the major differences in the analysis between the Draft EIS and the Final EIS:

**Air Quality** -- Since the air quality impact analysis was performed for the Draft EIS, several improvements have been made due to new information, review comments and improvements in the state-of-the-art. The most significant change was making the modeling method consistent with current EPA procedures to appropriately predict air pollutant transport and dispersion in areas of wind field convergence. Because of this improvement, the high values which were predicted west of Rifle, Colorado, do not appear in the Final EIS.

Another major change concerns assumed emission rates from proposed facilities. The improved values reflect rates corresponding to those used by the regulatory agencies. These emission rates have also been modeled separately for near-ground level sources and elevated sources, resulting primarily in greater near source ground concentrations of total suspended particulates (TSP). Some emission sources were removed due to the uncertainty of eventual operation (Southwest Power Plant, W.R. Grace Gasification, Federal programmatic leases) or due to their minimal size (Sodium mine). Some emission sources were added (Utah Synfuels, Hayden Power Plant) and the location of others was corrected (Chevron Upgrade, Superior-Pacific Project).

Improved preliminary analyses of atmospheric deposition impacts to lakes in the Flat Tops Wilderness have been incorporated into the Final EIS analysis.

In performing the analysis under the improved conditions, it was found that the west-southwest wind scenario represented the "worst-case" situation, rather than the west scenario as used in the Draft EIS.

Presentation of the results was improved by: displaying project location and production rate assumptions; including rudimentary background TSP maximum concentration predictions; presenting ranges of predicted values based on assumed and measured meteorologic conditions; and presenting the proportional contribution of sources to points of combined maximums.

As a result of all these changes, the impacts predicted in the Final EIS differ significantly from those presented in the Draft EIS. The most significant impacts are now anticipated to be air quality deterioration north of Rifle, east of Bonanza, Utah, and within Dinosaur National Monument, and the Flat Tops and Mt. Zirkel Wilderness Areas under the No Action Alternative.

These areas would not be further impacted significantly by any of the development alternatives.

**Hydrology** -- Several changes and additions were made to Chapter IV in response to comments, including the following:

1. clarification of the assumptions and methodology used in the groundwater model;

2. expansion of the analysis on leachate transport through the groundwater system;

3. clarification of water needs and the source of development water;

4. correction of conflicts between the No Action Alternative and development alternatives for water quality; and

5. the addition of new sections on the leaching of surface spent shale, surface disposal of spent shale, surface water impacts from in-situ leachates, and leachates associated with nahcolite and dawsonite recovery.

**Geology and Mineral Activity** -- Resource recovery estimates have been revised, and a new section has been added on gassy mine conditions.

**Surface Reclamation and Solid Waste Disposal** -- This section has been moved from Chapter III to Chapter IV since it primarily discusses potential environmental consequences and mitigation meas-

ures associated with reclamation. A section on cooling spent shale has been added to the text, and a discussion of direct revegetation on spent shale has been included under the "Surface Disposal of Spent Shale" section.

**Existing Rights** -- The liabilities of potential lessees for the Bureau of Mines facility at Horse Draw on Tract C-11 have been explained.

**Social** -- Chapter IV, Environmental Consequences, has been substantially clarified by revisions, and the mitigation section has been expanded. Lengthy responses have been provided in Part 2, Responses to Comments, that clarify portions of the analysis on facilities and services, and on the concept of "winners and losers" which helps correct misconceptions about impacts on at-risk groups such as the elderly.

**Economics** -- Population impact graphs in the Summary section have been revised to show the contributions of major projects to baseline growth in Meeker and Rifle. Chapter IV has been expanded to include a discussion of the danger of creating a one-industry economy, and a section on impacts to community bonding capacities and capital improvements requirements.

**Proposed Oil Shale Lease and Environmental Stipulations** -- The final phrase of the preamble stating that requirements of all regulations promulgated by the Secretary of Interior after the lease is signed are to be incorporated by reference, has been deleted.

Language was added to the lease to clarify the intent of the Department of Interior to lease both oil shale and associated minerals in the saline zone. Definitions in Section 1 of the lease have been expanded, and Section 10 now requires that a lessee specify the schedule for development of the associated minerals in the Detailed Development Plan.

Section 2 of the lease now specifies that all operations conducted under the lease be in compliance with all Federal, State and local statutes, regulations and standards.

Section 7 of the lease has been clarified to explain how royalty rates are determined, and an example is included in Part 2, Responses to Comments, Response Number 119.

Section 15 of the Environmental Stipulations has been rewritten to include socioeconomics and off-site transportation stipulations. The contents of the socioeconomic and transportation report have been clarified and the roles of the lessee, local government and the Federal government have been specified.

Minor editorial corrections were also made to the lease and environmental stipulations.

**Preferred Alternative** -- The Final EIS identifies a preferred alternative; to lease only Tract C-11. The rationale for this decision is included in the Summary and Chapter II, Preferred Alternative.

## Changes That Were Not Made To The Final EIS

Numerous changes and major revisions were recommended but were not made. Some of these are described below, but all have been explained in detail in Part 2, Responses to Comments.

**Baseline** -- The baseline described in the Draft EIS has not been changed. While it is recognized that some of the projects assumed under the No Action Alternative have been temporarily halted or slowed, it is also assumed that they could just as quickly start up again. The air quality baseline has been brought into line with the rest of the document. For more discussion of the rationale for this decision, see Response Number 4 in Part 2.

**Other Alternatives** -- Many commenters felt a whole range of alternatives should be analyzed in addition to those described in the Draft EIS. These included other energy alternatives, other site and tract alternatives, and alternative control technologies. No new alternatives have been analyzed. See Response Numbers 8, 125 and 138 in Part 2 for the rationale.

**Minerals Management Service** -- While the Final EIS was being prepared, the on-shore functions of the Minerals Management Service were transferred to the Bureau of Land Management. All references to that organization in the text and in the lease have been left unchanged, with the assumption that statements made regarding that organization will apply in the same manner to the newly responsible organization within BLM.

Finally, those who commented on the Draft EIS are encouraged to turn to Part 2 of the Final EIS to determine the disposition of their comments.

# SUMMARY

# SUMMARY

## Proposed Action

The Secretary of Interior proposes to offer one or two additional prototype oil shale tracts in the Piceance Basin of northwest Colorado.

This environmental impact statement examines the environmental and socioeconomic impacts that would result from that proposed action. The purpose of this document is to assist the Secretary of Interior in making a decision on whether or not to hold a lease sale in April 1983, and if one is held, which tract(s) to offer. It supplements the *1973 Prototype Environmental Impact Statement*, updating environmental data which has become available since that time, and analyzing the impacts of leasing an additional tract that was not included in that document.

## Alternatives Addressed

A total of four alternatives are examined in the Environmental Impact Statement: the No Action Alternative, the C-11 Alternative, the C-18 Alternative, and the Combined Alternative. These alternatives are based on tracts of land for which interest has been expressed by industry. Only two tracts (C-11 and C-18) are analyzed. The No Action Alternative examines the impacts of development that may occur without this leasing. The C-11 Alternative analyzes the impacts of leasing only Tract C-11. The C-18 Alternative examines the effects of leasing only Tract C-18. The Combined Alternative analyzes leasing both C-11 and C-18. The location of these proposed tracts is shown in Figure S-1.

Several kinds of development technology may be used to extract the shale oil and other resources. Three generalized, but reasonable development scenarios have been identified to cover the range of potential technologies on each tract. Any of the three kinds of development could occur on either tract.

The scenarios are: **direct mining and surface retorting** of the saline zone by room-and-pillar, chamber-and-pillar, sublevel stoping, crater retreat or similar methods; **mine assisted in-situ** which involves mining and surface retorting of a portion of the resources, and in-situ retorting of the remaining oil shale; and **true in-situ** processing which involves leaching away soluable minerals such as nahcolite, then retorting the shale oil in place by circulating a heated working medium such as gas, superheated water or steam.

Once any of these methods of processing the saline zone resources is completed, it would be possible to recover oil from upper zone shales by either direct mining or mine assisted in-situ methods.

Regardless of which development scenario would occur, the Environmental Impact Statement analyzes two reasonable levels of production: 25,000 barrels per day and 50,000 barrels per day (bbls/day) for each tract, and a 50,000 to 100,000 barrels per day total production rate if both tracts are leased.

Alternatives that were considered, but eliminated from further study included: offering more than two leases, offering tracts larger than 5,120 acres, analyzing other areas outside the tracts offered for expressions of interest, intertract bidding, analyzing other areas where interest was expressed but were not delineated as tracts, and delaying the lease sale beyond the proposed March 1983 lease sale date. A description of these proposals and why they were eliminated from further consideration is included in Chapter II. No other alternatives were presented that would have fewer apparent impacts, or that would better meet the Department of Interior's goals for the prototype program.

## Conclusions

The results of the impact analysis, focusing on the critical environmental elements that will be affected under the No Action and development alternatives are discussed below.

## No Action Alternative

In order to study the environmental consequences of any of the leasing alternatives, a baseline was constructed as a hypothetical starting point for measuring impacts. This baseline includes all of the development and land uses reasonably anticipated for the region in the foreseeable future. The specific projects included in this baseline are identified in Chapter II, No Action Alternative. It should be understood that every attempt was made to describe a reasonable baseline so that impacts predicted for the development alternatives would not

be exaggerated or underestimated. Some of the major projects assumed for baseline purposes include: the Colony project near Parachute that suspended operations while this document was being prepared; prototype oil shale tracts C-a and C-b that have both significantly slowed development, but that are anticipated to resume operations; Union, Mobil, Chevron and other private oil shale operations in the Grand Valley that are anticipated to continue forward with their current plans.

The critical environmental elements affected under the No Action Alternative include social, economic and air quality impacts to Rifle. Figures S-2 through S-4 show the average annual percent population growth rate of Meeker and Rifle, Colorado, predicted for the No Action Alternative and for the development alternatives. Between 1983 and 1988, the City of Rifle is anticipated to grow at an average annual compounded rate of approximately ten percent even without additional prototype leasing. Meeker would grow at approximately five to seven percent per year during the same time period. If these predictions hold true, it is likely that Meeker could sustain such a growth rate without serious social and economic hardship. However, Rifle would be approaching the point where social-structural breakdowns in a community could begin to occur (around 10 percent).

Rifle is more significantly affected in this model since it is closer to the private oil shale developments anticipated to take place in the Grand Valley. Variations in this baseline (such as a total Colony or Union shutdown) could significantly affect this rate of growth in the No Action Alternative, and therefore, would affect the significance of impact of the development alternatives. Figures S-2 through S-4 break out the larger projects in the baseline to show their projected contribution to total population increases predicted for Meeker and Rifle.

Air quality north of Rifle, east of Bonanza, Utah, within Dinosaur National Monument, and the Flat Tops and Mt. Zirkel Widerness Areas (see Figure III-1) may deteriorate due to industrial project emissions by the year 2003 under the No Action Alternative. The most significant impacts identified during the air quality analysis are possible exceedances of PSD Class II increments for total suspended particulates (TSP) and sulfur dioxide ($SO_2$) north of Rifle, and Class II TSP east of Bonanza, Utah. There is also a moderate potential that Class I TSP and $SO_2$ increments would be exceeded within Flat Tops Wilderness, and that the Colorado Category I $SO_2$ increment may be exceeded in Dinosaur National Monument. Ground level $SO_2$ concentrations in Mt. Zirkel Wilderness are predicted to be higher than the Class I increment, but this is due solely to a non-increment consuming source, for which PSD increment considerations do not apply. Additional prototype lease impacts are predicted to be within all PSD increments and would not contribute to the predicted exceedances under any of the development alternatives. Table IV-2 in Chapter IV, Environmental Consequences, details these predicted impacts, including major sources.

The decision maker should be aware that these impacts are predicted using atmospheric dispersion modeling which is state-of-the-art but "worst-case". Since no complex terrain/regional transport modeling approach has been adequately tested, and site specific information is lacking, the modeling approach applied "worst-case" assumptions, bracketing the worst possible situation in a conservative analysis. Site specific analyses, such as those required in the regulatory process, may yield low concentration values.

## Development Alternatives

The analysis of the environmental consequences of leasing indicates that a number of significant impacts would occur under all of the development alternatives. In most cases, impacts will vary by development scenario and production rate, rather than by the tract leased. In general, the higher the production rate, the more employees, product transportation needs, surface disturbance, and their resulting impacts, would occur. The different development scenarios create impacts that vary by the resource that is affected. These impacts are described in detail in Chapter IV, Environmental Consequences.

Total estimated in-place reserves of shale oil, nahcolite and dawsonite for each of the two tracts are similar, as shown below:

| Lease Tract | Shale Oil | Nahcolite | Dawsonite |
|---|---|---|---|
| C-11 | 9.2 bil bbls | 3.8 bil tons | 0.9 bil tons |
| C-18 | 10.2 bil bbls | 4.1 bil tons | 1.0 bil tons |
| Total | 19.4 bil bbls | 7.9 bil tons | 1.9 bil tons |

For purposes of comparison, the estimated in-place shale oil resource on only one of these tracts is approximately equal to the proven oil reserves on the North Slope of Alaska. The important variable, however, is the amount of this resource that can be recovered using known methods of mining and retorting. Using currently proven methods of shale processing, up to 28 percent of this shale reserve could be recovered. New technologies could significantly improve this recoverability rate, however, none have successfully been proven to date. It is

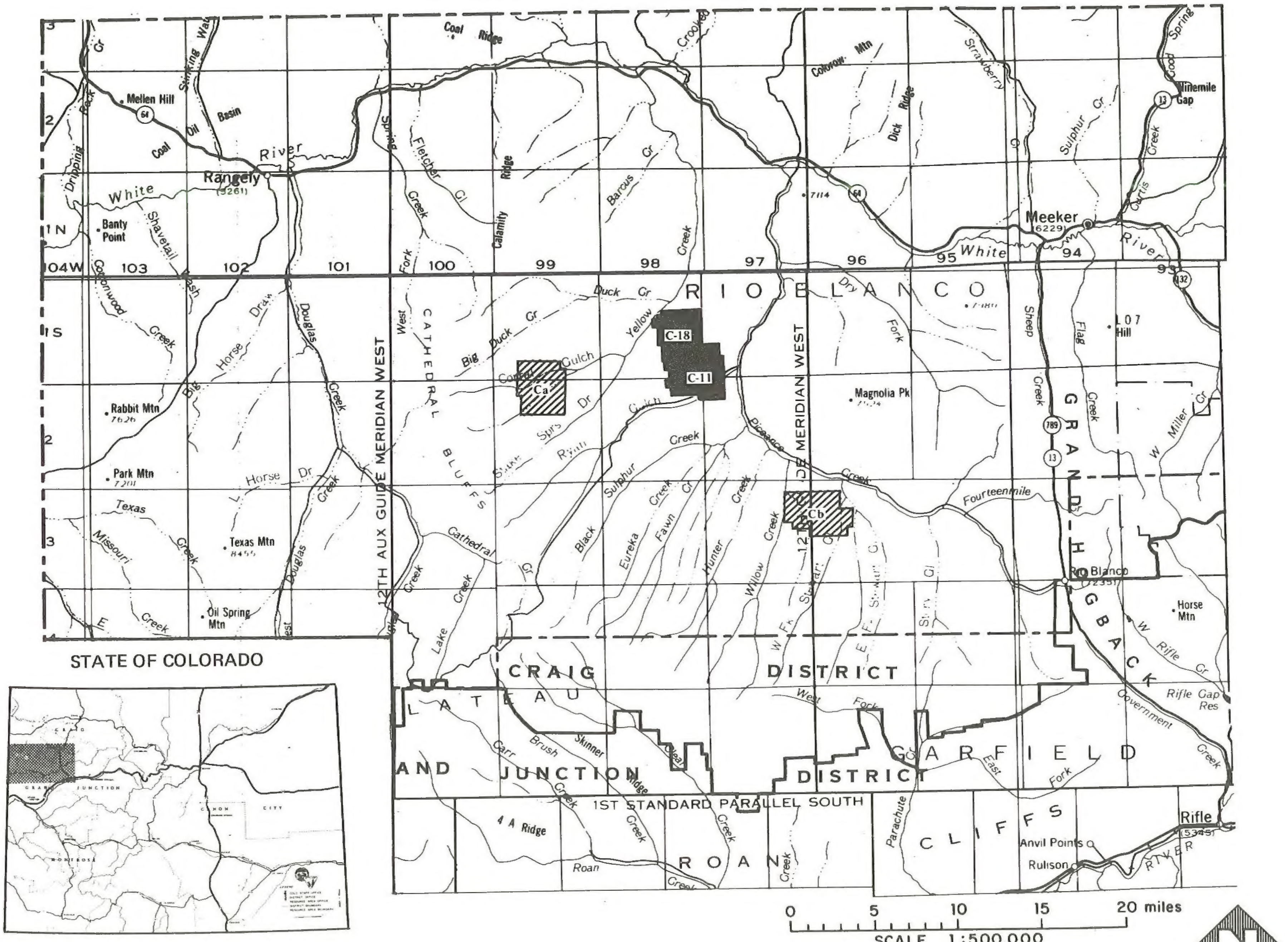


Figure S-1 Location of proposed and existing Prototype Oil Shale Lease Tracts in Colorado

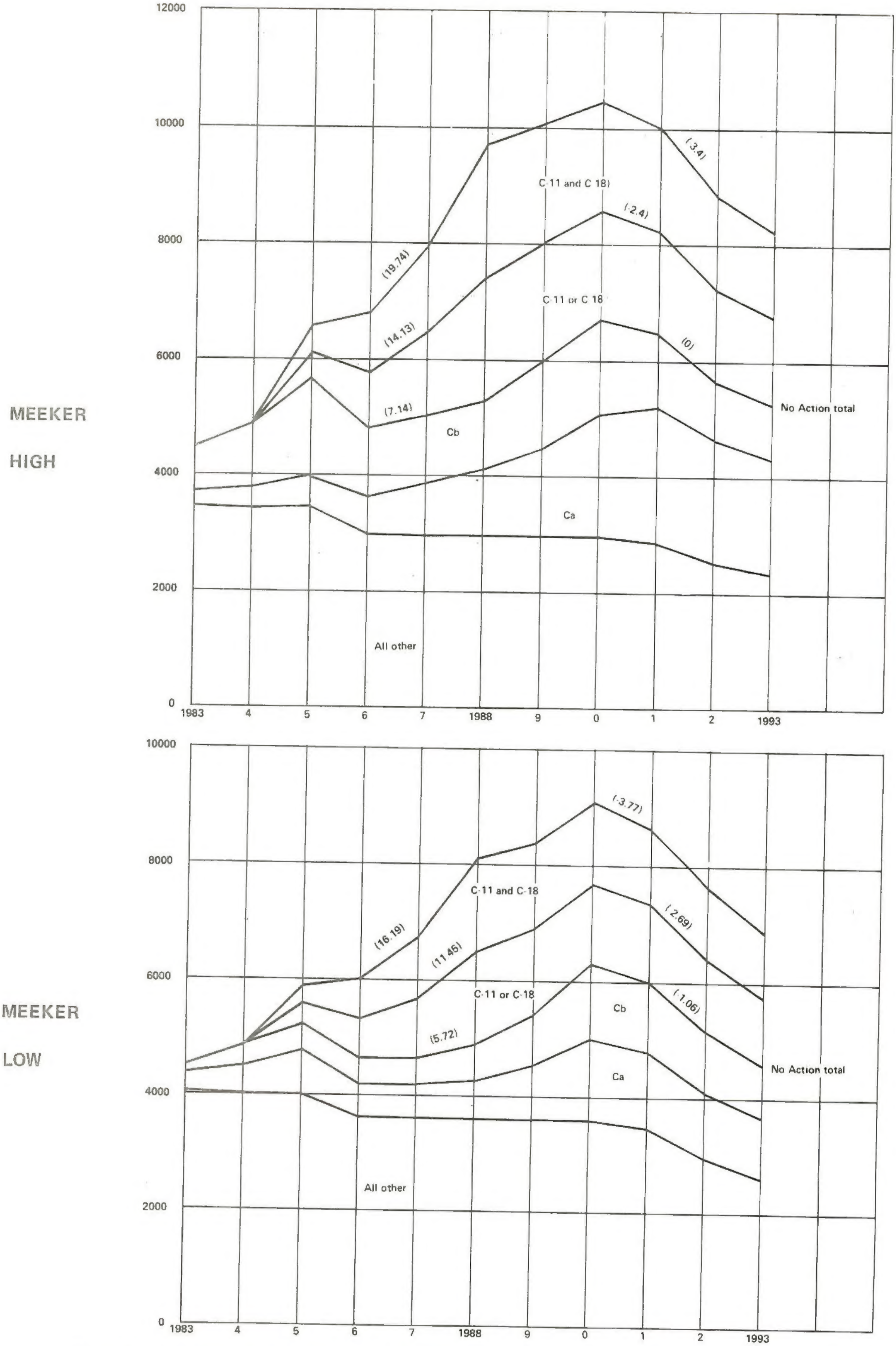


**Figure S-2** Predicted annual population growth by alternative for Meeker, Colorado, showing contribution of major projects included in the No Action Alternative. Numbers in parenthisis are the percentages of annual growth rates predicted for 1983 - 1988 and 1988 - 1993.

RIFLE

HIGH

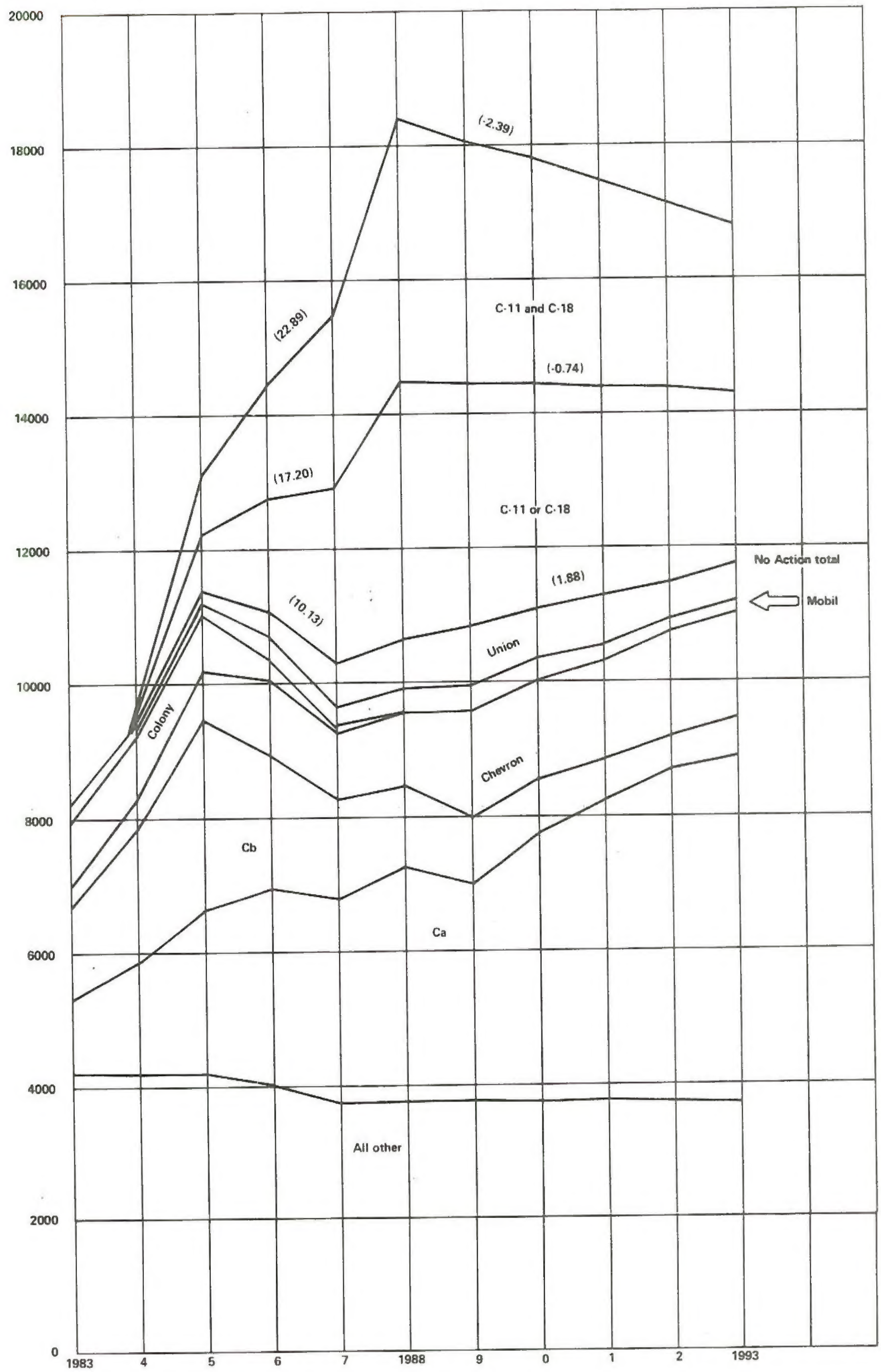


Figure S-3 Predicted annual population growth by alternative for Rifle, Colorado, showing contribution of major projects included in the No Action Alternative. Numbers in parenthisis are the percentages of annual growth rates predicted for 1983 - 1988 and 1988 - 1993.

RIFLE

LOW

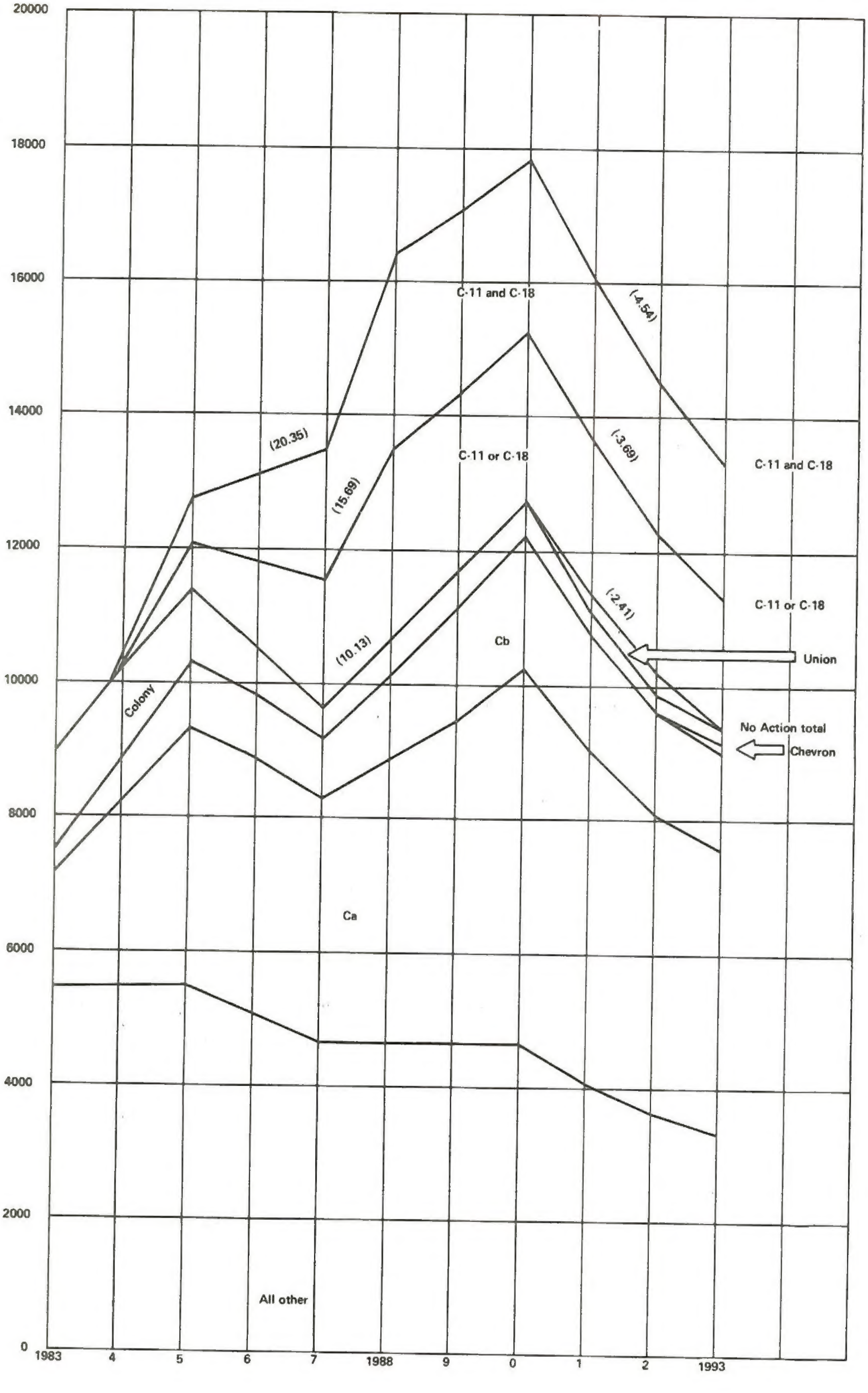


Figure S-4 Predicted annual population growth by alternative for Rifle, Colorado, showing contribution of major projects included in the No Action Alternative. Numbers in parenthisis are the percentages of annual growth rates predicted for 1983 - 1988 and 1988 - 1993.

felt that there is not enough difference in reserves between the two tracts to favor one tract or the other. Production from either tract could conceivably continue at a rate of 25,000 or 50,000 bbls/day for up to 100 years.

If the decision is made to lease only one tract, there are advantages and disadvantages associated with leasing either C-11 or C-18. Tract C-18 would be easier to develop and to reclaim than C-11, since the topography is more gentle, there is more available topsoil for covering spent shale disposal piles, and there are more north-facing slopes. C-11 is dissected by drainages dipping into Ryan Gulch, containing steep sideslopes with a southern exposure. Less erosion and faster reclamation would occur on C-18, thereby benefitting livestock forage and wildlife habitat which would be more quickly replaced.

Tract C-11 contains alluvial valleys and floodplains that could be potentially affected, whereas C-18 does not. C-11 has considerably more critical deer winter range than C-18, and more known raptor nests. On the other hand, the density of cultural sites is greater on C-18 than on C-11.

Most of Tract C-18 is presently encumbered by a sodium lease and an approved nahcolite recovery mine plan. Prior to any oil shale leasing on this tract, an agreement would have to be developed between the current sodium lease holder and the government, that would assign the sodium lease to the successful bidder. It is assumed that development of this mine will occur simultaneously with oil shale if C-18 is leased, and independently (sodium minerals only) if C-11 is leased. This situation would result in generally fewer socioeconomic, transportation and surface disturbance-related impacts under the C-18 Alternative than under the C-11 Alternative. On the other hand, C-11 is unencumbered by a sodium lease, presumably making it easier to lease and develop that tract than C-18.

Tract C-11 includes the Bureau of Mines Research Facility at Horse Draw, that may or may not be an advantage to a potential developer. If the lessee determines that the Horse Draw Facility would be beneficial to his operations, an agreement would have to be reached whereby the lessee would assume all liabilities associated with the facility. If not, the Bureau of Mines would reclaim the facility in accordance with their existing approved reclamation and abandonment plan. C-11 also contains more public water reserves and existing pipelines than C-18, which may be affected by development of Tract C-11.

The critical elements that should be taken into consideration by the decisionmaker prior to leasing additional prototype tracts, include air quality, hydrology, socioeconomics and transportation. These elements and the factors to be considered are described below.

As previously stated, it is probable that air quality would deteriorate north of Rifle, east of Bonanza, Utah, and within Dinosaur National Monument, Flat Tops and Mt. Zirkel Wilderness Areas under the No Action Alternative. These areas would not be further impacted significantly by any of the development alternatives. Local air pollution episodes would probably be more severe on Tract C-11 due to topographical influences -- frequent temperature inversions and drainage winds are likely. Tract C-18 modeling analysis predicted greater local impacts (due to the lower emisssion source elevation) and slightly higher $NO_x$ values in the Mt. Zirkel Wilderness Area. Local scale modeling, including diurnal meteorologic effects, would be necessary to adequately quantify these differences, however.

Water quality and quantity problems could occur under all of the development alternatives. Because the two lease tracts are located between the two major drainages in the basin (Piceance and Yellow Creeks), the potential for hydrologic impacts to these creeks is increased. Mine dewatering would affect the groundwater contributions to both Piceance and Yellow Creeks regardless of the alternative selected and is more or less proportionate to the production rate. How the dewatering is conducted and the mitigation performed will determine the resulting impacts to the groundwater system.

Two principal groundwater quality problems have been identified, and are associated principally with any kind of in-situ retorting: contamination from leaching of flooded retort chambers and backfilled mine workings, and aquifer mixing. Leaching of flooded retort chambers could be the most serious problem, since control of retort process contaminants is difficult to achieve underground. Leaching of backfilled mine workings could be as difficult to control as the retort chambers. The contaminants most likely to increase are pH, sulphates, sodium, chlorine, certain trace elements, and certain organic compounds. The impacts from these pollutants are highly site-specific and vary greatly with local hydrology. Movement of the contaminants through the groundwater system may take centuries since groundwater movement is slow.

Mixing of aquifers could be a problem in the lease tract area because of the difference in water quality of the two aquifers. Mine dewatering will cause the movement of water between aquifers. Accelerated mixing could occur after mining operations have ceased if the entire Mahogany Zone has been extracted. By removing this aquitard, mixing of the two aquifers would occur more rapidly.

Surface water supply impacts were also modeled. Predictions show that reductions in the flow of the White River would amount to about four percent at a production rate of 100,000 bbls/day, a relatively insignificant amount to the flow of the White River, but this water would be lost to other uses such as agriculture. Of more significance is the reduction in flow in Yellow and Piceance Creeks resulting from mine dewatering. Piceance Creek could begin experiencing extended periods of no flow, and Yellow Creek could remain dry for more than 50 percent of the time. These effects could be mitigated by water reinjection, however, the success of such a program is still unproven.

Population increases will occur with additional leasing, creating severe social and economic impacts to the communities of Rifle and Meeker, if the baseline impacts identified for the No Action Alternative occur as described above. Total populations could increase at an annual rate of 15 to 17 percent between 1983 and 1988 in Rifle if only one tract is leased, and from 20 to 23 percent per year if both tracts are leased (see Figures S-3 and S-4). This range could create very severe social structural breakdowns for the community.

Meeker would not be as severely affected, as shown in Figures S-2. Leasing one tract could result in annual population increases of 11 to 14 percent from 1983 to 1988. Leasing both tracts would increase that rate of growth to 16 to 20 percent annually, potentially creating some severe breakdowns in the community's ability to cope with growth. Other communities in the region would also be affected but are not predicted to reach these growth rates.

It is evident that the key to these predictions is the actual growth that will take place without additional leasing. The decisionmaker is encouraged to examine development potential of private oil shale projects in the region prior to offering additional tracts for lease, and comparing real growth to the No Action Alternative constructed here.

The analysis shows a significant increase in traffic on Piceance Creek Road, and State Highway 13 to Rifle, resulting from trucking of solid minerals. If all solid mineral products anticipated from direct mining or mine assisted in-situ scenarios are shipped from the proposed lease tract by truck to market, or the Rifle railhead, 1,000 to 2,000 additional trucks would be using these road segments daily, if only one tract is leased. These numbers would double if two tracts are leased. These numbers are high enough to warrant consideration of other methods of product transportation, although initial product transportation could be handled over the existing system. These impacts would occur even if a pipeline were constructed to transport shale oil. A slurry pipeline, or more probably a rail system will have to be considered by the lessee in the future to transport solid products.

While a number of trade-offs must be considered in determining which of the two tracts would be more desirable to lease, it is very clear that leasing both tracts would have the most impacts. Due to their proximity to one another, environmental and socioeconomic impacts are compounded under the Combined Alternative, in some cases resulting in severe impacts.

Most of Tract C-18 is currently leased for sodium minerals to the Wolf Ridge Corporation. Since early 1982, BLM has been attempting to work out an agreement with Wolf Ridge Corporation whereby their interest in the sodium lease could be assigned to a successful bidder on C-18. BLM and Wolf Ridge have been unable to resolve these legal issues and for this reason, C-18 will not be offered for lease at this time. The preferred alternative is to offer only Tract C-11 for lease.

# CHAPTER I

## PURPOSE AND NEED FOR ACTION

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## Introduction and Background of the Prototype Program

### The Resource

The oil shale deposits of the Green River Formation occur in several geologic basins in Colorado, Utah and Wyoming. Although much of the oil shale resources contained in these basins cannot be recovered with current technology, estimated economically recoverable reserves could satisfy the United States' oil needs well into the 21st century.

Approximately 72 percent of the land, overlying 80 percent of the oil shale resource, is managed by the Bureau of Land Management. Most of this Federal land is located near the depositional centers of these basins containing the richest deposits.

The Piceance Basin of Colorado is the richest of these basins, and is one of the richest single oil shale deposits in the world. In an area of some 1,500 square miles, well over a trillion barrels of shale oil are estimated to occur.

It is important to recognize that the oil shale in the basin is of high quality, it is concentrated in a relatively small area when compared to oil shale deposits elsewhere in the world, and that the majority of the richest deposits are federally administered. The quality and availability of the oil shale resource and the other associated minerals in the Piceance Basin is discussed in more detail in Chapter III, Geology and Mineral Activity.

### Leasing

Attempts to recover shale oil in the Piceance Basin have met with varying degrees of interest and success since the early 1900's. The Mineral Lands Leasing Act of 1920 enabled the Secretary of Interior to lease oil shale on Federal lands, provided that no lease tract exceeds 5,120 acres, an annual rental of 50 cents per acre is assessed, and that no individual or firm can hold more than this total acreage under lease in the United States. Except for these provisions, the Secretary was given broad discretion to select lease tracts and develop lease terms.

It was not until the early 1970's, however, that a leasing program was developed and oil shale leases were actually sold. In 1971, the Prototype Oil Shale Leasing Program Statement was released, and industry was requested to submit lease tract nominations. Twenty tracts were nominated: 13 in Colorado, 4 in Utah, and 3 in Wyoming. The Department of Interior designated six of these tracts to be offered for lease -- two in each of the states. On April 30, 1973, the *Final Environmental Impact Statement (EIS) for the Prototype Oil Shale Leasing Program* was released, and the lease sale was held in early 1974. That document, referred to here as the *1973 Prototype EIS*, examined the regional impacts of oil shale development, as well as the site specific impacts of leasing the six tracts. Each of the other potential lease tracts nominated by industry were given only brief treatment in the *1973 Prototype EIS*.

The history of Federal oil shale leasing is discussed in detail in *An Assessment of Oil Shale Technologies Volume II* (Congressional Office of Technology Assessment 1980).

### Objectives of the Prototype Program

The goals of the Federal Prototype Oil Shale Leasing Program were established in 1973 by the Secretary of Interior. They are:

1. to provide a new source of energy to the Nation by stimulating the development of commercial oil shale technology by private industry;

2. to ensure the environmental integrity of the affected areas and at the same time develop a full range of environmental safeguards and restoration techniques that will be incorporated into the planning of a mature oil shale industry, should one develop;

3. to permit an equitable return to all parties in the development of this public resource; and

4. to develop management expertise in the leasing and supervision of oil shale development in order to provide the basis for future administrative procedures.

The initial Prototype Program was designed with the concept that six lease tracts in three states would be developed with significantly different mining and processing technologies, and that commercial-scale production of about 250,000 barrels per day (bbls/day) would be achieved by 1980. However, the Wyoming leases were not sold, and development of the Utah tracts was suspended due

to legal ownership questions. Development has only recently resumed in Utah, postponing production plans by several years.

### Existing Leases

The four leases issued under the prototype program are called U-a and U-b in Utah, and C-a and C-b in Colorado. The Utah tracts are in the early stages of development of access preparatory to sinking mine entries.

Colorado lease Tract C-a, held by the Rio Blanco Oil Shale Company, originally proposed an open pit mine with aboveground retorting. They planned to dispose of the processed shale off-tract. Subsequent to leasing, the Department of Interior determined that it lacked adequate authority to lease surface use of off-site lands. C-a then switched to an experimental modified in-situ process which was successfully tested in 1981-1982. However, it was determined that the original open pit mining proposal would provide for a more economic return and more efficient recovery of the resource. Further development at C-a is now nearly at a standstill in anticipation of pending legislation permitting offsite disposal of processed shale.

Tract C-b is leased to the Cathedral Bluffs Shale Oil Company. They originally proposed an underground mine with aboveground retorting. As development progressed, it was discovered that the shale may be too fractured to allow for the extraction of economic quantities of oil shale. Their plans were then changed to a modified in-situ process. C-b has also significantly slowed development operations while reevaluating engineering feasibility and awaiting improved economic conditions.

## Need for Additional Prototype Leasing and the Proposed Action

The objectives of the prototype program have only been partially realized. Since modified in-situ development, underground mining with aboveground retorting, and possibly open pit mining are the only technologies to be elected for use under the program, additional leasing would be required to ensure that all available technologies for oil shale are adequately tried. Specifically, two kinds of development have been suggested: true in-situ processing and mining associated minerals concurrently with oil shale. None of the existing prototype leases lend themselves well to the mining of associated minerals concurrently with oil shale.

As discussed above, the original intent of the prototype program was to lease six tracts as assessed in the *1973 Prototype EIS*. Since no bids were received on the Wyoming tracts offered for sale in 1974, a total of only four tracts have been leased.

With this in mind, in November 1981, the Assistant Secretary of Interior for Land and Water Resources directed that the Bureau of Land Management provide for offering one or two additional tracts under the prototype program by early 1983. (This is the proposed action of this document.) If feasible, these lease offerings would provide the opportunity for development of oil shale concurrently with associated minerals as well as other appropriate technologies, in an effort to fulfill the original goals of the prototype program.

This program was begun in February of 1982 with the issuance of a Call for Expressions of Interest which was published in the *Federal Register*. The results of this call and the identification of tracts to be assessed is described in Chapter II.

## Purpose of the Document

### Major Federal Action

Once the decision was made to pursue additional prototype leasing, it was clear that the impacts of offering up to two additional tracts in Colorado were not sufficiently covered by the analysis in the *1973 Prototype EIS*. It was determined that additional prototype leasing would be a major Federal action requiring the preparation of an Environmental Impact Statement under the requirements of the National Environmental Policy Act of 1970. This EIS will address the environmental and socioeconomic impacts of leasing up to two additional prototype oil shale tracts.

This EIS will assist the Secretary of Interior in coming to a decision on whether or not to offer additional leases, how many, and which one(s) to lease.

### Relationship to Other Documents

This EIS is being prepared within the context of other land use and resource management decisions, as well as within a framework of concurrent

oil shale decisions. Several associated documents are described below that relate to this EIS and are referenced in the text.

**1. 1973 Final Environmental Impact Statement for the Prototype Oil Shale Leasing Program** -- The *1973 Prototype EIS* was prepared to examine the regional effects of establishing the Prototype Oil Shale Leasing Program, and to look at the site-specific impacts of leasing six particular tracts. This EIS is a supplement to the 1973 EIS since it is examining the site-specific impacts of leasing up to two additional prototype tracts under the original program.

This EIS will reference the 1973 document where appropriate, however, significant changes in environmental laws and regulations have occurred in the intervening years, requiring a more comprehensive analysis. In addition, more accurate environmental and socioeconomic data has recently been made available that was not used in the 1973 EIS. Although this is a supplemental EIS, it is structured as a complete and comprehensive analysis that is intended to stand on its own where necessary as a site-specific EIS.

**2. Environmental Impact Statement on the Federal Oil Shale Management Program** -- The Bureau of Land Management is in the process of developing a long-term oil shale leasing program for proven development technologies on Federal lands. The associated Environmental Impact Statement for that program is currently being prepared, and is referred to here as the Programmatic EIS. The Programmatic EIS will look at the regional impacts of implementing the leasing program on a three state area (Colorado, Utah and Wyoming). For Colorado, it is using much of the same baseline information and assumptions as this EIS is using. To avoid duplication between the two documents, some referencing of the regional analysis is made in this EIS. While the scope of the two EISs is significantly different, every attempt has been made to be consistent where analysis overlaps.

**3. White River Resource Area Management Framework Plan** -- The Management Framework Plan (MFP) is the land use and resource management decision document that identifies the framework within which resources will be managed in the White River Resource Area. The central Piceance Basin has been identified as having priority for the development of oil shale, with several specific tracts (including Tract C-11), that were delineated in the *1973 Prototype EIS* and proposed for future oil shale development. The other tract being analyzed in this EIS, C-18, is part of an existing sodium lease. The MFP stresses the need for the concurrent development of oil shale with sodium minerals to maximize the economic recovery of leasable minerals while minimizing the environmental effects of extracting them.

Therefore, leasing of either or both of these tracts is in conformance with the existing MFP. A number of stipulations and mitigation measures are included in the MFP to protect other resource values. These measures and other portions of the MFP are referenced in this document.

## The Leasing Process

### The Lease Sale

Once the Final Environmental Impact Statement is released, the Secretary of Interior will make the decision on whether or not to move forward with the preferred alternative. The Secretary's decision will have been made with the advice and recommendations of the Regional Oil Shale Team. The Regional Oil Shale Team is comprised of representatives of the governors of Colorado, Wyoming and Utah, and the BLM State Directors of those states. The decision, including any justifications or background material necessary to support that decision, will be issued in the form of a "Decision Document". The decision document will specify the actual lease sale date, which is tentatively scheduled for April, 1983. A lease sale notice will be published in the *Federal Register* at least 30 days prior to the sale.

Should a decision be made to lease these additional prototype tracts, operations would proceed under the terms of a lease designed to achieve the objectives identified in "Introduction and Background" (Chapter I, above). To achieve this goal, an interlocking set of bonus, royalty, bonding and performance provisions have been developed and are in the proposed lease located in Appendix A of this document. Some of the key elements of the lease are summarized below.

### The Lease

The primary lease term is for 20 years and as long thereafter as there is production in commercial quantities. Readjustment of royalty and operating terms may be made at the end of each 20 year period, although the royalty is adjusted regularly by an index factor to reflect regional oil and gas prices derived from the Producers Price Index. Annual rental of 50 cents per acre per year for the use of the land will be charged as required by the Mineral

Leasing Act of 1920, as amended, and is creditable against royalties.

Royalty is money due and payable to the lessor for the removal of the resource from the leased lands by the lessee. Under the proposed lease, the royalty rate would be adjusted, depending on the actual oil content of the mined material and the market value of locally produced liquid hydrocarbons with the base year of 1974. This would result in a basic royalty rate on October 1982 production, for example, of approximately 43 cents per ton of oil shale mined for processing that contains 30 gallons of shale oil per ton of material. Additional royalty would be collected on minerals other than shale oil produced under the lease.

To encourage development and avoid long delays in shale oil production from the leases, payment of minimum royalties would be required whether or not there is actual production. Beginning in the sixth lease year, the minimum royalty payments will be based on production rates derived from the estimated recoverable oil shale reserves contained in each tract. The required minimum royalty payment will increase each year through the 15th lease year and then remain the same through the 20th year at which time the lease terms may be readjusted.

Early production incentives are also provided which will permit, under certain circumstances, the credit of a portion of development costs incurred during the early years of a lease against bonus and royalty payments due the government.

This is only a summary of a portion of the lease itself. The proposed lease and the socioeconomic and environmental stipulations required of the lessee are contained in Appendix A. Provisions of the lease will be referred to throughout this document, so the reader should be familar with both the lease and the associated environmental stipulations.

## Required Authorizations

Prior to any actual development of the tracts, a detailed development plan must be submitted and approved by the Minerals Management Service. At that time, the Department will have the opportunity to impose any additional controls and mitigation measures which appear necessary. Approval of the Detailed Development Plan is contingent upon the lessee adequately meeting all environmental requirements and compliance with the National Environmental Policy Act.

After lease issuance and before the submission of a development plan to the Minerals Management Service which will provide for operations other than exploratory operations on the leased tract, the lessee will be required by lease stipulations to obtain at least one full year of initial baseline environmental data against which the actual environmental impact of the proposed development will be measured.

The collection of baseline data and specific parameters to be measured as part of a monitoring program will be integral parts of the detailed development plan to be prepared before the third anniversary of the lease. These plans must provide for compliance with all of the established environmental criteria and receive Departmental approval prior to the start of operations. They must include detailed projected analyses of the amount and types of expected waste materials, the location and extent of the disposal areas, the types and amount of vegetation that will be used in land restoration, and adequate assurance to the Department that the lessee has designed the disposal restoration systems to protect the long run productivity of the affected areas. These plans will be subject to public hearings conducted by the Department on the environmental aspects of the proposed operations. Only after such hearings and consultation with State and local officials may the plans be approved, and then only after the Minerals Management Service with Bureau of Land Management concurrence is satisfied that all lease terms, stipulations and provisions will be satisfied.

A bond would be required as security to ensure that the approved development restoration plan would be conducted in a manner designed to minimize degradation of the environment and that all other related lease terms would be met.

In addition to the detailed development plan, the lessee is responsible to obtain all applicable Federal, State and local permits and authorizations associated with the mine and ancillary facility development. The State of Colorado indicates that this may involve obtaining more than 100 permits to build and operate an oil shale plant (Colorado Energy Research Institute 1981). An effort has been made by the State of Colorado to streamline this permitting process for industry by establishing a Joint Review Process. This is a voluntary program involving the cooperation of all affected agencies in an effort to reduce the cost and workload requirements of the developer and government agencies in applying for and acquiring permits and other authorizations. In any case, it is the responsibility of the lessee to obtain these permits either independently or through the State's Joint Review Process.

## Issues and Concerns

In an effort to determine the scope of analysis of this document, public meetings were held on March 24, 25 and 26, 1982, in Meeker, Grand Junction and Denver, Colorado, respectively. The public was asked to identify their concerns and the issues that should be addressed in the EIS. These comments were obtained verbally and in writing.

Issues that were identified and which have been addressed in this EIS, are listed first below. These concerns have been summarized and grouped into categories for ease of reference. Additional issues which were raised and are covered by laws or regulations that require their analysis in the EIS, are not included in this listing. Also listed are those concerns and issues that are beyond the scope of this document. Many questions were raised about a permanent oil shale leasing program and about site-specific development plans that will be handled in other documents. Those issues that have not been addressed in this document, and the reasons for excluding them from analysis, are listed secondly.

### Significant Issues Raised During Scoping and Addressed in this EIS

a. The need to expand the *1973 Prototype EIS* analysis to include a wide range of current environmental knowledge.

b. The analysis should describe the cumulative impacts of additional prototype leasing on top of existing and proposed development in the region.

c. A comparison should be made of energy requirements of different development technologies and the net energy values produced.

d. The conflict between oil and gas recovery and oil shale development should be examined.

e. Air quality impacts, particularly as they affect Class I areas and wilderness areas is a widespread concern. The uncertainties of existing air quality models, control technologies, siting patterns, acid rain, and anticipated population increases are specific concerns related to air quality impacts.

f. Water quality and water consumption problems were identified as significant issues. Specific concerns included salinity, effects of leachates and retort waters, toxicity, water availability for wildlife and agriculture, water reuse and total consumptive use.

g. Legal problems associated with leasing oil shale on an existing sodium lease, where both resources are intermingled, was identified as a concern.

h. Several socioeconomic concerns were presented. Included among these issues are: the need to assess cumulative direct and indirect impacts of population growth, revenue sources and timing, "boom-bust" effects, housing, lifestyle changes, labor requirements and sources, and the need for socioeconomic mitigation measures.

i. Impacts on game and non-game species of wildlife is a serious concern, both from direct and indirect effects of the oil shale development.

j. Mined land reclamation, stabilization and leaching problems with spent shale and potential soil erosion impacts were identified as concerns.

k. The impacts to the existing transportation systems and the potential for building and financing new transportation were identified as issues. This includes both product transportation needs as well as increased demand on highways due to workers and increased populations.

### Issues Raised During Scoping But Not Addressed in this EIS

a. Several concerns were raised regarding the need for additional prototype leasing at this time. Specific concerns were that baseline monitoring of existing prototype leases should be completed prior to additional leasing; the questionable demand for shale oil; and that the prototype program has served its purpose and that the Department of Interior should be concentrating its efforts on a permanent, long-term oil shale leasing program.

*As previously stated, the effort to lease additional prototype tracts is necessary to achieve the original goals of the prototype program. While the Department is moving forward on development of a permanent long-term leasing program, it was also felt that extending the opportunity to private industry to develop commercial oil shale technology on public lands, in the interim, was in the public interest and within the intent of the prototype program.*

b. Some changes to the original prototype lease were recommended, such as adding or deleting certain environmental stipulations, and changing the method for determining royalties and their payment.

*Based on BLM's experience to date, it is felt that the leasing process itself, as identified in the existing prototype program, should not be changed. Some portions of the lease have been clarified, and some of the environmental stipulations in the lease have been fine tuned to correct problems with the original stipulations, but no major changes have been made to the lease. The lease and the stipulations as proposed for this round of leasing are included in Appendix A.*

c. Several commentors felt that the technologies to be used for the prototype leasing should be restricted or specified in this document.

*The prototype program is intended to stimulate the development of new technologies. This could include any type of concurrent development of oil shale with associated minerals, a true in-situ retort method, or other appropriate development techniques. In order to evaluate potential impacts, a range of realistic development scenarios have been examined that meet the criteria of the prototype program. However, it would be inappropriate to restrict potential development proposals prior to lease sale.*

d. It was felt that the fair market value of the resources to be recovered under each development scenario should be identified in this EIS.

*The market value will have to be assessed after the lease sale during the post bid evaluation process. Criteria are currently being developed to perform this evaluation. However, it is felt that such a determination is beyond the scope of this EIS.*

e. Alternatives to oil shale as an energy source should be examined.

*Conservation and other energy alternatives have not been analyzed in this EIS. One of the objectives of the Prototype Oil Shale Program is to stimulate the development of commercial oil shale technology by private industry. Energy alternatives were examined as part of the* 1973 Prototype Oil Shale EIS, *and will have to be considered in detail for leasing under the Department's proposed long-term oil shale program. Further analysis is believed to be unnecessary at this time for a decision to lease one or two tracts to encourage development of oil shale concurrently with associated minerals.*

f. Several issues were brought out regarding the tertiary effects of oil shale development such as impacts from additional power plants, upgrading and refining facilities and secondary industrial development that may be required for an expanded oil shale industry.

*These kinds of effects have been identified where possible, but their impacts have not been analyzed. While tertiary development is anticipated, too little is known about the magnitude, location or nature of the development to prepare any meaningful analysis.*

g. Concerns were expressed about worker health and safety on the job.

*The Environmental Stipulations of the prototype lease, Section 5 give responsibility for the health and safety of workers, and compliance with Federal health and safety laws and regulations to the lessee. Industry's plans to comply with these laws will be contained in the Detailed Development Plan.*

h. The need for a Spill Prevention Control and Countermeasure Plan for hazardous wastes and oil spills was identified as a concern.

*Again, the Environmental Stipulations of the lease, Section 7 require submission of a spill contingency plan with the Detailed Development Plan. Specific provisions in these stipulations also provide for responsibility for handling, use and storage of hazardous substances.*

## Baseline Assumptions

In order to assess the cumulative impacts of leasing additional prototype tracts, a baseline had to be established upon which to add the incremental impacts of this leasing. The No Action Alternative (see Chapter II), identifies all existing projects and proposed projects that are assumed for purposes of this baseline. Only those projects that were deemed most likely to be constructed within a reasonable time frame as of April 1982 were included. Thus, both the Colony Oil Shale project and the LaSal pipeline were assumed for the baseline. Both of these projects were put on hold indefinitely subsequent to construction of this baseline. While this may seem to skew the baseline to reflect more development than will actually occur without additional prototype oil shale leasing, it is not unreasonable to expect these projects or similar ones to come on-

line in the future. Therefore, both Colony and LaSal have been left in the No Action Alternative.

The proposed lease and environmental stipulations included in Appendix A of this document are also assumed for analysis purposes. The mitigation measures proposed in the stipulations are "committed mitigation". In other words, they are measures within the authority of the Department of Interior to enforce or require. Failure to comply with these stipulations shall be grounds for termination of the lease as described in Section 10 of the lease.

Additional, specific committed mitigation measures that are not included in the environmental stipulations of the lease are as follows:

1. Human disturbances will be restricted within areas designated as critical deer winter range between December 1st and March 31st when definite conflict areas are identified as determined by the mining supervisor. Where necessary, these conflict areas will be posted and closed to protect wintering deer herds.

2. Any land use activity within deer or elk migration routes that would result in an adverse impact and inhibit or defer animal movement, will be prohibited as determined by the mining supervisor.

3. Prohibit any land use activity within an average of 0.25 mile of any active raptor nest that would permanently alter the habitat and adversely impact nest productivity. Actual areas of restriction are variable in size depending on topography, raptor species, and onsite inspection. Active raptor nests located during future field surveys or baseline data collection efforts will have a restriction zone identified and managed according to this stipulation, zones presently designated are as follows:

**Tract C-11**

T2S, R97W, 6th PM

Sec. 6: N1/2NE1/4, SW1/4NE1/4, S1/2NE1/4NW1/4, SE1/4NW1/4, NW1/4NW1/4SE1/4.

Exception to this stipulation would be in accordance with the Eagle Protection Act, the Migratory Bird Treaty Act of 1918, and current amendments.

4. Prohibit any human disturbance within an average of 0.25 mile of any active raptor nest between March 1 and July 31. Actual buffer zone areas are variable in size depending on topography, raptor species, and onsite inspection. Season of restriction is variable dependent upon species of raptor present. Active raptor nests located during future field surveys or baseline data collection efforts will have a restriction zone identified and managed according to the stipulation. Zones presently designated are as follows:

**Tract C-11**

T2S, R97W, 6th PM

Sec. 6: N1/2NE1/4, SW1/4NE1/4, S1/2NE1/4NW1/4, SE1/4NW1/4, NW1/4NW1/4SE1/4.

Exception to this stipulation would be in accordance with the Eagle Protection Act, the Migratory Bird Treaty Act of 1918, and current amendments.

5. Additional Endangered Species Act Section 7 consultation with the US Fish and Wildlife Service will be required prior to approval of the Detailed Development Plan when necessary information on water requirements is available to accurately assess potential impacts to the Colorado squawfish.

6. All trees to be cleared for development will be purchased by the lessee prior to construction, from the Bureau of Land Management, White River Resource Area, and disposed of by the lessee as follows:

All stems, stumps, and branches greater than four (4) inches in diameter shall be: (a) removed from Federal land for resale or for private use; or (b) cut into lengths not exceeding four (4) feet and scattered as directed by the mining supervisor.

All stems and branches less than four (4) inches in diameter shall be disposed of as directed by the mining supervisor.

The existing White River Resource Area Management Framework Plan (MFP) directs the Bureau's activities in the study area. It is assumed that the stipulations and guidelines for development and multiple resource management contained in the MFP will be applied and are also committed mitigation measures. The BLM Manual requirements for particular resource elements are also assumed, and are identified as appropriate in the text. Other specific assumptions are identified where particular resource data is unknown or is widely varied, to facilitate analysis. These assumptions are identified under the applicable resource elements, and are consistent for each resource element throughout the analysis process.

# CHAPTER II

## DESCRIPTION OF THE ALTERNATIVES

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# DESCRIPTION OF THE ALTERNATIVES

## Introduction

On February 18, 1982, industry and the general public were asked to indicate any interest they had in additional prototype leasing in the Piceance Basin. The call for expressions of interest asked for specifics on the kind of development technology proposed and the tract that the respondent was interested in. The areas offered included potential lease tracts delineated both in the White River Resource Area Management Framework Plan and the *1973 Prototype EIS*. In addition, the existing sodium lease tracts in the basin were also offered.

A total of 10 responses were received. Six of these were either negative statements, comments on the prototype program in general, or expressions of concern about leasing certain tracts. Four responses were positive expressions of interest on specific tracts, all proposed the development of oil shale concurrently with associated minerals in the Saline Zone. Shell Oil Company proposed an in-situ process to be used on Tract C-11 (as identified in the *1973 Prototype EIS* and referred to as Tract I in the call for expressions of interest). Nielson Resources Corporation proposed in-situ development on the Rock School Corporation Sodium Lease, an area of some 1,320 acres. Industrial Resources, Incorporated expressed interest in the eastern part of the Wolf Ridge Corporation sodium lease tract to use a direct mining and surface retorting process. Multi Minerals Corporation also expressed interest in the eastern portion of the Wolf Ridge sodium lease tract for an integrated in-situ development process.

Based on these responses, it was determined to identify a maximum of two tracts that are logical mining units not to exceed 5,120 acres each in size for consideration in this document. These two tracts were delineated with the assistance of the Minerals Management Service, Oil Shale Office based on minability and the potential for future development. Further details describing the tracts are included in each alternative below. Tract C-11 was included in the *1973 Prototype EIS* and that designation will be carried on in this document. The expressions of interest on the sodium lease tracts were consolidated into a single logical mining unit of less than 5,000 acres with good access and development potential. This tract is new and will be referred to here as C-18. These tracts are shown on Figure II-1.

For each of these two tracts, Minerals Management Service also described potential, reasonable development technologies that could be used. Since impacts differ depending on how the tract is developed, a range of reasonable development scenarios were identified that can apply to either tract. These development scenarios are referred to in the impact summaries of each alternative, and are described in detail immediately following the alternatives.

The alternatives, are structured as follows: leasing either Tract C-11 or Tract C-18, or leasing both, or not leasing any new prototype tracts at all. These leasing alternatives will be analyzed for a range of reasonable development scenarios as subalternatives. It is assumed for analysis purposes that the prototype lease sale will take place in April 1983 for each of the development alternatives. The four alternatives and the possible development scenarios are described below. The No Action Alternative is discussed first to provide a baseline for activity and resource uses that will occur in the area without additional prototype leasing. Committed mitigation measures that are applicable to all alternatives have been discussed in Chapter I, Baseline Assumptions.

## No Action Alternative

### General Description

The No Action Alternative would not offer any additional prototype tracts for leasing to augment those which are currently in existence. No new annual production would occur and there would be no further disturbance as a result of additional prototype tracts.

Impacts in the area would occur without additional leasing as a result of existing projects which would continue. Current mineral activity in the region is summarized below. Other resource activities and land uses in the area are described in Chapter III under the appropriate heading.

## Existing Mineral Activity

One of the most significant resource activities in the Piceance Basin is mineral development. The following discussion summarizes the major activities currently under development and projected for the near future.

### Oil Shale

Oil shale resources in the Piceance Basin are being developed under two existing Federal prototype leases. In addition to these leases there is planning and development of private oil shale holdings in and adjacent to the Piceance Basin.

**C-a Tract** - Gulf Oil Corporation and Standard Oil Company (Indiana) were the successful bidders for Colorado Tract C-a in 1974 and organized the Rio Blanco Oil Shale Company to effectively develop this tract. During the period 1977-1981, Rio Blanco Oil Shale Company successfully completed a modified in-situ demonstration project which provided information needed to evaluate commercial modified in-situ development of Tract C-a. The study indicated open pit development with surface retorting and offsite disposal of overburden and processed shale would be the most efficient method with respect to oil shale recovery. However, the uncertainties of economics and congressional approval of legislation allowing the Secretary of Interior to lease additional land for overburden and waste disposal off-tract prevents Rio Blanco Oil Shale Company from commencing with commercial scale open pit development at the present time. Finalized development plans incorporating the above mentioned preferred technology are unavailable. Therefore the following assumptions have been compiled as guidelines for impact assessment purposes.

Development scenarios have been formulated by the Programmatic Oil Shale Environmental Impact Statement team based on a production rate ranging from a low of 50,000 barrels per day (bbls/day) to a high of 100,000 bbls/day by the year 2000. For both scenarios construction activities would begin in 1983 with steady-state production levels achieved by 1998. The production expectancy for Tract C-a is 30 years.

For the 50,000 bbls/day development scenario, 1,700 workers would be employed at steady-state production. Approximately 8,000 acre feet of water per year(acre ft/yr) from the White River drainage would be required for project implementation. Total surface disturbance would encompass 3,550 acres: 420 acres at the surface facility site, and 3,130 acres involving disturbances reclaimable within a shorter time period (e.g., product pipeline routes, utility corridors, overburden stockpiles, and spent shale piles).

For the 100,000 bbls/day development scenario, 2,700 workers would be employed at steady-state production. Approximately 16,000 acre ft/yr of water from the White River drainage would be required. Total surface disturbance would encompass 7,100 acres: 840 acres at the surface facility site, and 6,260 acres involving disturbances reclaimable within a shorter time period.

A survey indicates the percentage of employees residing in nearby communities to be Rifle-83 percent, Meeker-13 percent, Rangely-3 percent, and elsewhere-1 percent, if the future situation imitates current conditions. This preference would apply to both scenario levels. Figure S-1 shows the location of Tract C-a.

**C-b Tract** - Federal Oil Shale Lease Tract C-b was awarded April 1, 1974 and is currently managed by the equal-interest partnership between Occidental Oil Shale Corporation and Tenneco Shale Oil Company, doing business as Cathedral Bluffs Shale Oil Company. Cathedral Bluffs Shale Oil Company submitted a detailed development plan for surface retorting in 1976 followed by a modified plan in 1977 to incorporate modified in-situ retorting. Currently, Cathedral Bluffs Shale Oil Company is re-evaluating present development plans before proceeding into a commercial development phase. Development plans incorporating preferred commercial technology are not available at the present time. Therefore, the following assumptions have been formulated for impact assessment purposes.

The Programmatic Oil Shale Environmental Impact Statement team assumes a year 2003 production rate ranging from a low of 21,000 bbls/day to a high of 76,000 bbls/day. For both scenarios, construction activities would peak at 1985 with steady-state production levels achieved by 1995. The production expectancy for Tract C-b is 30 years. Cathedral Bluffs Shale Oil Company socioeconomic assessment surveys estimate future distribution of the permanent work force to be 60 percent in Rifle, 25 percent in Meeker, and 10 percent in Silt, and 5 percent in other locations.

For the 21,000 bbls/day development scenario, 670 workers would be employed at steady-state production. Approximately 8,000 acre ft/yr of water from the White River drainage will be required for project implementation. Total surface disturbance would encompass 1,700 acres: 200 acres at the surface facility site, and 1,500 acres involving disturbances reclaimable within a shorter time period.

For the 72,000 bbls/day development scenario 2,100 workers would be employed at steady-state production. Approximately 12,000 acre ft/yr of

R. 98 W.

R. 97 W.

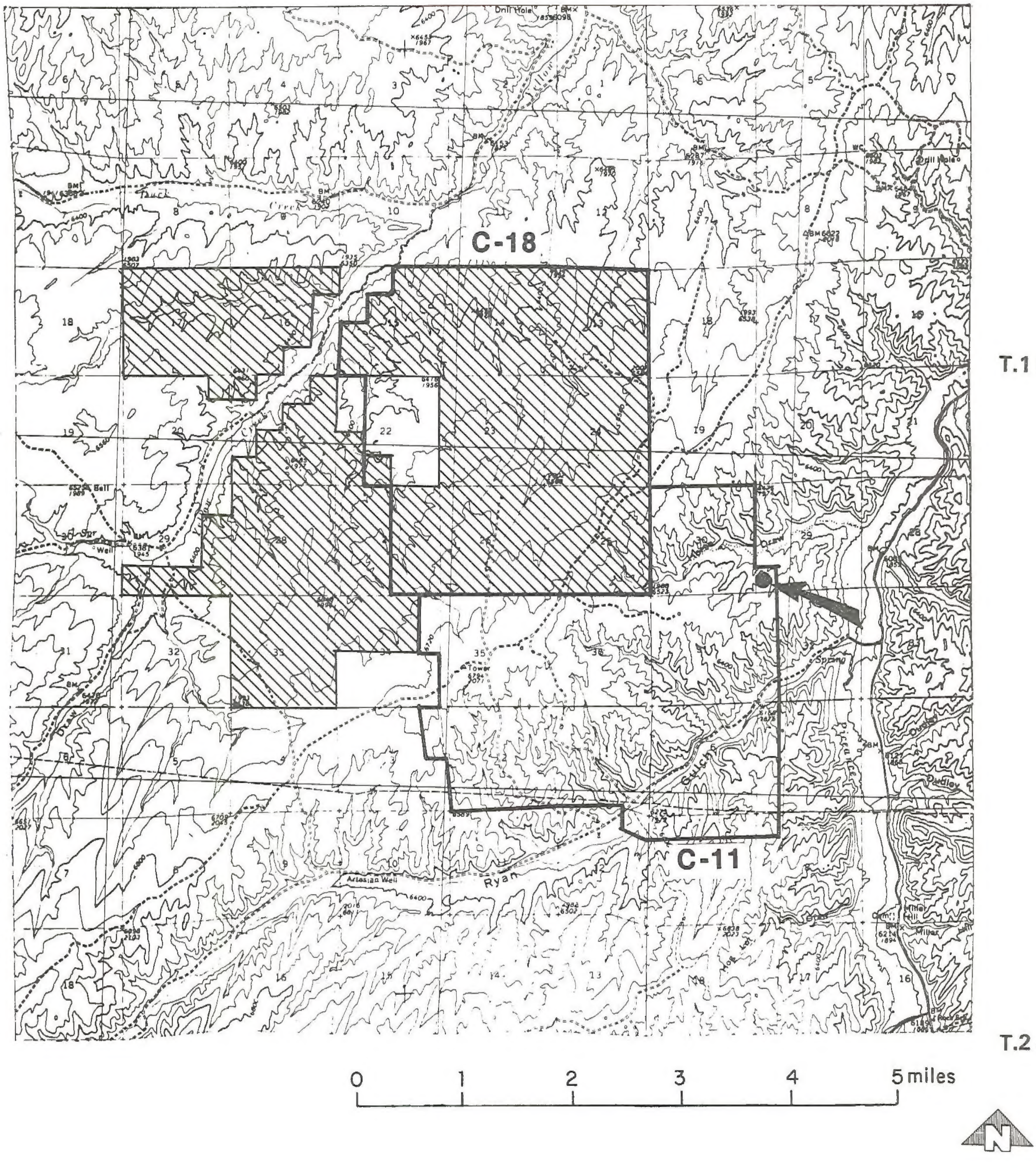
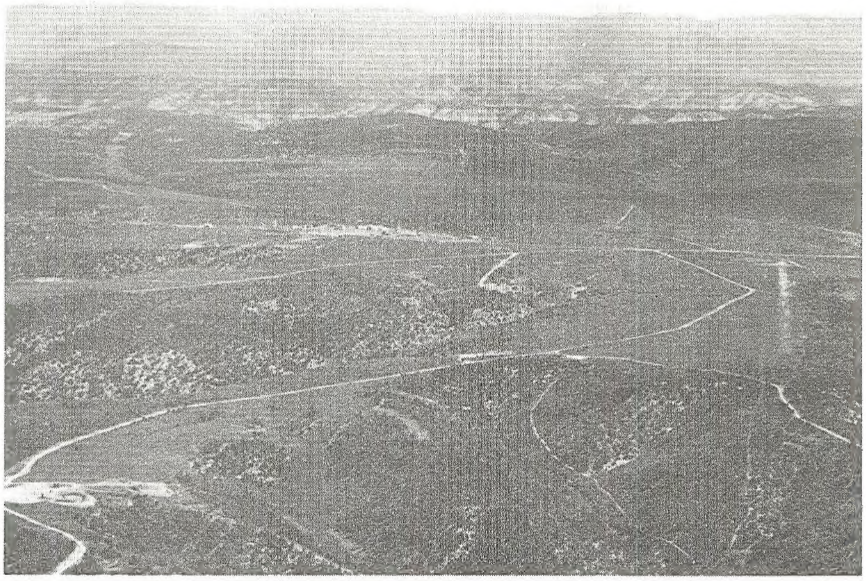



Figure II-1 Tracts C-11 and C-18 Showing Wolf Ridge Corporation's Existing Sodium Lease (shaded) and the Bureau of Mines Horse Draw Facility (arrow)



**Aerial view looking northeast across the Piceance Creek Oil and Gas Unit. Disturbances from development of the unit include an airstrip (far right), numerous access roads, well pads (example well lower left), and a gas processing plant (center). June 10, 1982**

**Aerial view looking north-northeast at pipelines leading to the gas processing plant in the Piceance Creek Oil and Gas Unit. Note the producing well in the lower third of the photo. June 10,1982**

water from the White River drainage would be required for project implementation. Total surface disturbance would encompass 5,325 acres: 630 acres at the surface facility site, and 4,695 acres involving disturbances reclaimable within a shorter time period. Figure S-1 shows the location of Tract C-b.

**Private Oil Shale Development** - Private ownership of oil shale involves the Colony (Exxon-Tosco) Project in Parachute Creek; Union Shale Oil Project also in Parachute Creek; Chevron Clear Creek Project on Clear Creek and Skinner Ridge; Mobil Oil Co. southwest of Anvil Points; and Superior-Pacific west of Rifle, Colorado. Together these projects are anticipated to have the following magnitude of development:

1) Construction of the sites has either started or will have started by 1986.

2) Employment will be 2,580 in 1986; 4,280 to 6,530 in 1992; 4,980 to 9,730 in 1993; and 6,880 to 11,720 in 1998.

3) Peak production will range from 63,000 bbls/day in 1986; 73,000 bbls/day to 163,000 bbls/day in 1990; 123,000 to 213,000 bbls/day in 1992; 173,000 to 263,000 bbls/day in 1998; and 213,000 to 303,000 bbls/day in the year 2000.

4) The regional socioeconomic impact monitoring system report of November 1981 by the Colorado West Area Council of Governments estimates the employees (excluding Union) will live in the following communities: Grand Junction-10 percent, Clifton-1 percent, DeBeque-30 percent, Parachute-16 percent, Rifle-14 percent, Battlement Mesa-25 percent, Glenwood Springs-1 percent, Silt-1 percent, New Castle-1 percent, Other and not reported-1 percent.

By county, this would be: Garfield - 58 percent, Mesa - 41 percent, and Other - 1 percent.

Union Oil Company will have 28 percent of their employees (700 to 3,200 total) in Rifle, 19 percent in Grand Junction, 13 percent in Parachute and the remainder on the mine site camp.

5) Water use of the companies will total 11,500 acre ft/yr by 1986; 16,000 to 24,000 acre ft/yr by 1992; and 18,000 to 35,400 acre ft/yr by 1998 from the Colorado River.

6) Total disturbed acres will range from 11,200 to 20,500 acres by the termination of the projects sometime in the year 2016 assuming a 30 year life of the mine. Mine plant facilities will occupy approximately 1,670 to 3,020 acres when full production is reached in 1998.

**Sodium**

A nahcolite recovery mine plan was approved in 1981 for the development of a sodium mine that includes portions of Tract C-18 (see Figure II-1). The mine will be developed by the room and pillar method.

At full production, approximately 177 acres of surface will be disturbed; 15 acres for the plant site, 108 acres for topsoil storage and 3.5 miles of paved access.

At full production, the mine will employ approximately 440 workers. Ninety of these employees would be based in Rifle as their nahcolite trucking crew. These crews would make 90 round-trips per day in 26 ton capacity trucks from the mine to the Rifle railhead. The remaining 350 employees will be commuting from Rifle (35 percent), Meeker (50 percent), Rangely (10 percent), and other (5 percent). Water for the mine will be obtained from a well (producing 72,000 gal/day) in the upper aquifer being pumped at 50 gal/min, 24 hours per day. Approximately 36,000 gal/day will be used for potable purposes, the remaining 36,000 gal/day will be used for dust suppression and other activities associated with mining. Total water use will be approximately 81 acre ft/yr. Once the mine is in full production (1985) the expected life of the mine is 30 years (2015).

In addition, the Bureau is currently evaluating three Sodium Preference Right Lease Applications (PRLAs). Two of the PRLAs are located immediately north and east of Tracts C-18 and C-11. It is anticipated that these will be operated as a single mine. The other PRLA is located to the southwest of the tracts, and is expected to develop as a second mine.

Mine development is expected to be the same for both PRLA mines. The following assumptions have been made for purposes of this analysis. Development of the two PRLA mines would occur simultaneously with full production of 227,592 tons of sodium minerals annually for each mine by 1988. Finished product would be trucked to rail facilities at Rifle, Colorado utilizing 26 ton capacity trucks requiring approximately 33 1/2 truckloads per working day for each mine. Each mine would have 72 employees on a 2 shifts/day and 5 day/week schedule. Employees are expected to live in the same communities as the approved sodium mine employees.

Oil shale may not be processed under a sodium lease. Shale recovered during the mining process is considered a by-product and will be stored on the surface at least for the first five years of operation. Processing would produce approximately 228 tons

of waste per day, or 59,280 tons annually. Mine life would be in excess of 50 years at stated production levels. Exploration work is expected to begin in 1984 with development of the mines to start in 1985. Approximately 14.5 acres of surface disturbance would occur at each mine for the mine plant sites and shale storage for a total of 29 acres surface disturbance, excluding roads.

Water requirements would be about 13.6 percent of that required by the issued sodium lease mine plan or 11 acre ft/yr per mine.

### Bureau of Mines Facility

The Bureau of Mines has a research shaft located in Horse Draw on the eastern portion of proposed Tract C-11 (SW1/4, Sec. 29, T1S, R97W) as shown in Figure II-1. The Bureau of Mines has been actively studying mining environmental problems, mitigation and processing tests for concurrent development of oil shale, nahcolite and dawsonite in the lower saline oil shale facies of the Parachute Creek Member of the Green River Formation.

The test shaft site has recently been operated by Multi Minerals Corporation under a cooperative agreement with BLM and the Bureau of Mines. The Bureau of Mines has completed their planned research acitivity at the facility. Currently, only custodial management is taking place until a decision is made on what the future of the facility will be.

### Oil and Gas

The oil and gas drilling efforts throughout the Piceance Basin are assumed to continue at approximately the current rate in the Sagebrush Hills II, Rio Blanco, Piceance Creek and Yellow Creek Oil and Gas Units. Since all the units are "producing units", at least two wells per unit must be drilled per year for a total of ten wells per year to fulfill unit requirements. Companies like Sun Gas and Rio Blanco Natural Gas are more active and can be expected to drill as many as five to nine wells per year for their units. This means a maximum of 18 wells could be drilled per year. Assuming each drill rig requires approximately 10 to 12 people to operate plus eight support people (water haulers, dirt contractor, roustabouts, company representatives, etc.) and can drill a well on an average of every three months, this means as many as 80 people and four rigs will be operating in a year to drill 18 wells.

Water required for each well drilled is highly variable depending upon size of the hole, type of mud program and water encountered downhole. On a rough average approximately 75.6 gallons (1.8 barrels) of water are used per foot of hole drilled. The average depth of hole drilled is between 8,000 and 12,000 feet. Water consumption per hole then is between 1.86 to 2.78 acre feet of water. For 18 wells, this would amount to some 33.4 to 50.1 acre feet annually.

Well pads will vary from 1.7 to 3.6 acres in size. Access roads will be on the average 25 feet wide and 1.3 miles long. Therefore, the average surface disturbance per well will be between 5.7 and 8.6 acres in size or, for the 18 anticipated wells per year, 102 to 155 acres.

### Coal

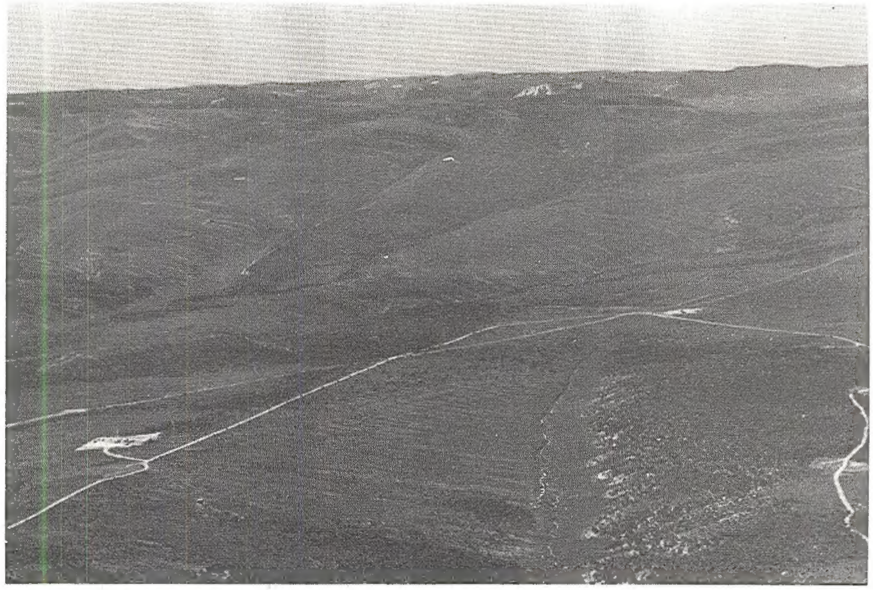
Coal, although peripheral to Piceance Basin, is being developed in the Ninemile Gap area northeast of Meeker, and the Scullion Gulch area east of Rangely. Northern Coal Company is active in the Ninemile Gap area with coal production planned to reach 3.4 million tons per year from 1987 to 1992. Peak production will be 4.2 million tons per year from 1993 to 2008. Peak employment will be 672 by 1993. Total surface disturbance will be 140 acres. Seventy-three percent of the employees are expected to live in Meeker, with the balance living in Craig and Hayden.

The Moon Lake Power Project is being constructed near Bonanza, Utah. At full production the coal mine near Rangely which will supply the project will produce 2.4 million tons of coal per year which will be transported by rail to Bonanza. Peak production employment in Colorado in 1987 will be 410 employees living primarily in Dinosaur and Rangely. Water use will be 367 acre ft/yr derived from four alluvial wells drilled adjacent to the White River. Total surface disturbance will be 700 acres by 1990 and will reach a maximum of 1000 acres.

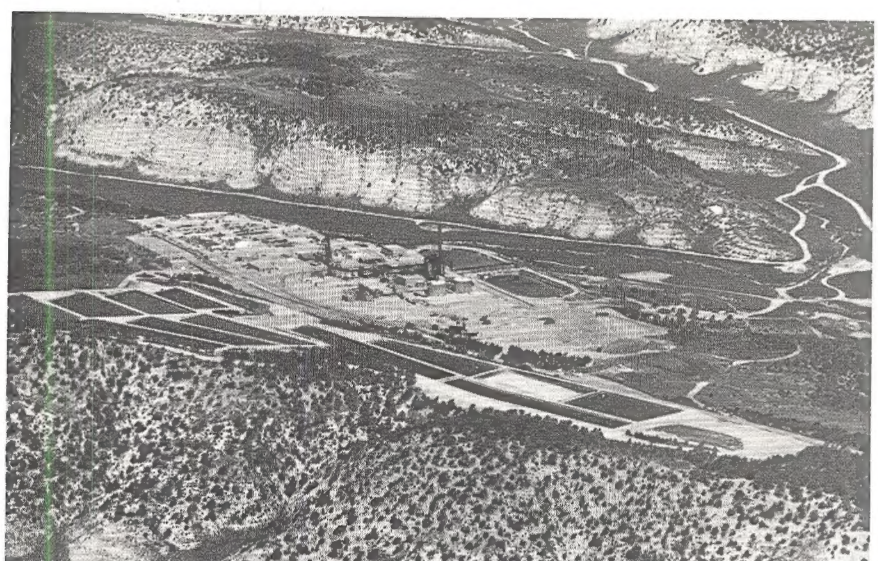
### Summary of Impacts

The following impacts would occur even without leasing additional prototype oil shale tracts. This is only a summary of the significant anticipated impacts; a more detailed analysis is included in Chapter IV, Environmental Consequences.

**Air Quality** -- Air quality north of Rifle, east of Bonanza, Utah, within Dinosaur National Monument, and the Flat Tops and Mt. Zirkel Wilderness Areas is also anticipated to deteriorate by the year 2003 under the No Action Alternative. The most significant impacts identified during the air quality analysis are possible exceedances of PSD Class II increments for TSP and $SO_2$north of Rifle, and Class II TSP east of Bonanza, Utah. There is also a moderate potential that Class I TSP and $SO_2$ increments would be exceeded within Flat Tops Wilderness,

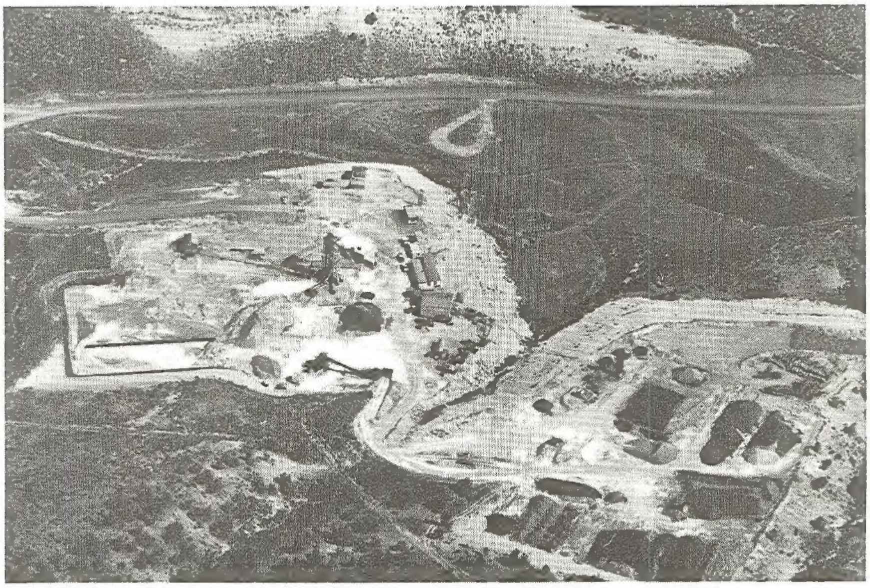


Aerial view looking south at drilling and pipeline activity southwest of C-a tract. June 10, 1982

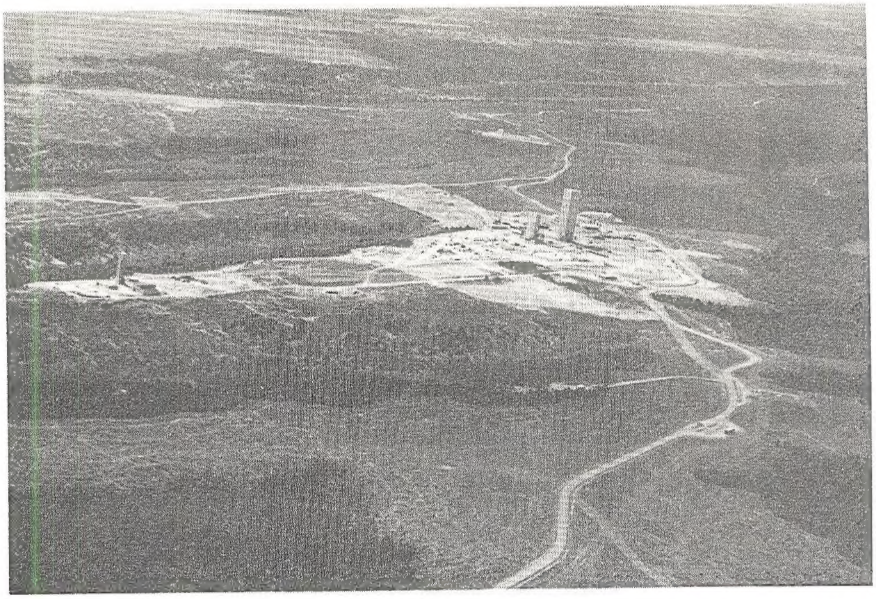


Aerial view looking northwest across modified in-situ test area on tract C-a. June 10,1982

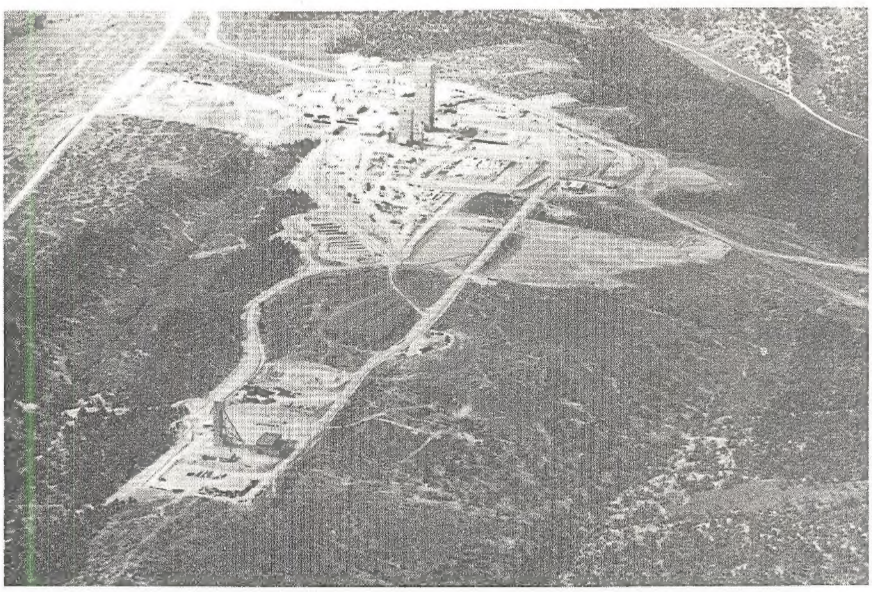
View looking north from the chainings on tract C-11.



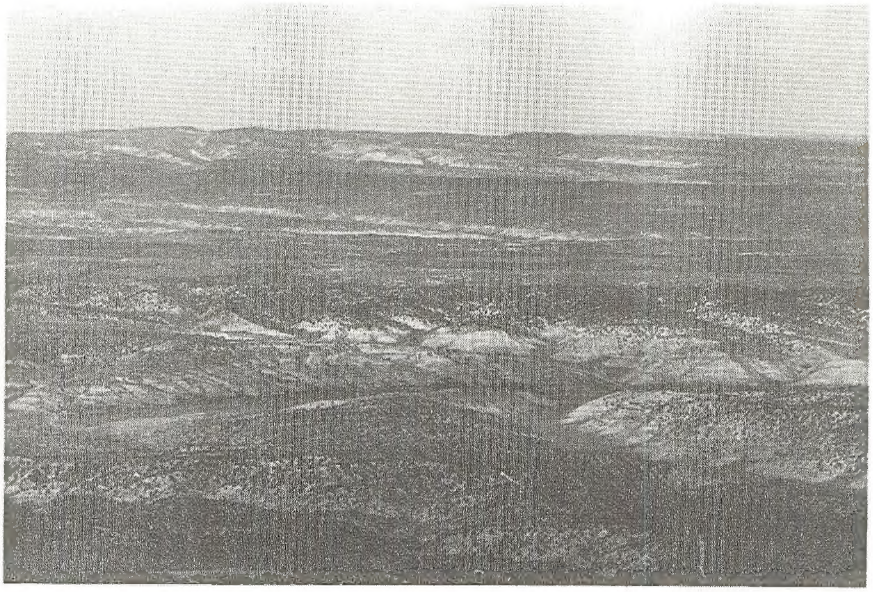
Aerial view looking north across the Bureau of Mines oil shale test facility in Horse Draw. Mine shaft is located in the left center of the photo. June 10, 1982



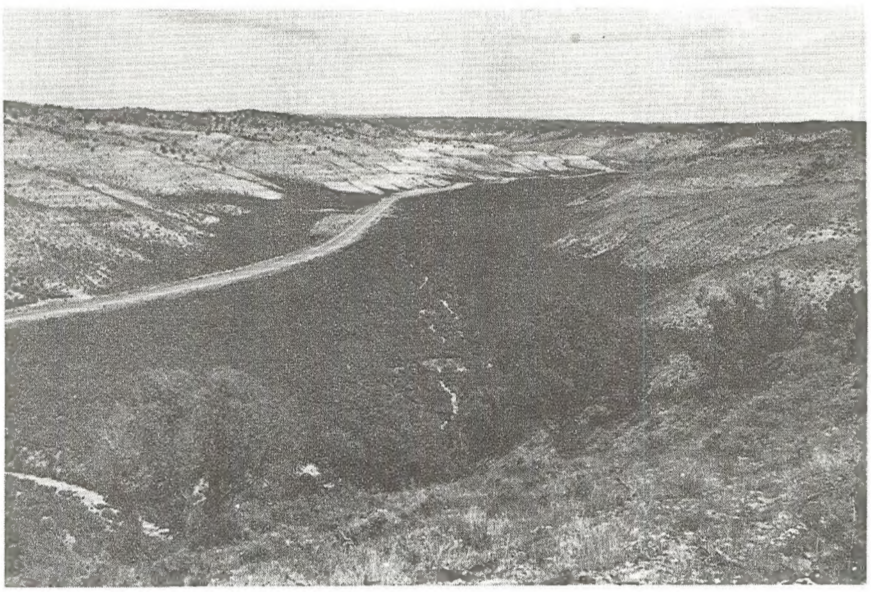
**Aerial view looking southeast across the mine development area on tract C-b. The Production and Service Shaft head frames are the two large structures in the right center of the photograph. June 10, 1982**



**Aerial view looking south across the mine development area on tract C-b. Ventilation/Escape Shaft head frame is in the lower left corner of the photo. June 10, 1982**



Aerial view looking northwest across Piceance Creek and Horse Draw at both tracts C-11 and C-18. June 10, 1982



View looking northeast down Ryan Gulch and the southern exposure (left side of the photo) of tract C-11.

and that Colorado Category I $SO_2$ increments may be exceeded in Dinosaur National Monument. Ground level $SO_2$ concentrations in Mt. Zirkel Wilderness Area are predicted to be higher than the Class I increment, but this is due solely to a non-increment consuming source, for which PSD increment considerations do not apply. Table IV-2 in Chapter IV, Air Quality, details these predicted impacts.

**Geology** -- Nahcolite will be mined on portions of Tract C-18 and could result in the permanent loss of 13.5 million tons (8 million barrels) of oil shale (0.3 percent of the estimated recoverable amount of oil shale).

Oil and gas exploration and production could continue unimpeded and temporarily prevent extraction of 72 percent of the in-place oil shale per acre.

**Alluvial Valleys, Floodplains, and Agricultural Lands** -- Water quantity and quality in Yellow Creek may be affected, remaining dry 50 percent of the time and having lowered water quality with increases in dissolved solids by the continued development of C-a Tract. Impacts upon the floodplain of Yellow Creek are not expected.

Off-tract development such as pipeline routes and utility corridors may temporarily impact agricultural lands. Between 6,770 and 10,160 acres of agricultural land would be permanently impacted from population growth and the associated conversion of agricultural lands to urban expansion. This conversion could be significant if it occurs on prime orchard lands in Mesa County.

**Soils** -- Approximately 20,000 acres of surface disturbance would occur in the region, resulting in an unknown quantity of topsoil displacement and loss of soil productivity. Significance of these impacts would directly correlate to the success of reclamation. Soil impacts would be significant if reclamation is unsuccessful or inadequate.

**Hydrology** -- Mine dewatering resulting from the development of Tract C-a and C-b and the sodium mine may result in a decrease of the groundwater contribution to the streamflows of Piceance and Yellow Creeks. The flow of Yellow Creek could be reduced by as much as 50 percent and the creek could remain dry over half the time. Groundwater contributions to Piceance Creek may be reduced by as much as 18 cfs, causing an increase in the periods of no flow. The reductions to both Piceance and Yellow Creeks are a worst case analysis, and do not consider reinjection or augmentation. The quality of both Piceance and Yellow Creeks could be impacted as a result of leachates from in-situ retorts, backfilled mine workings, and spent shale disposal piles. As mines are dewatered, springs and wells within the vicinity of the lease tracts may be impacted resulting in shifts in livestock and grazing use. Once dewatering ceases water levels within the lease tract area would be expected to return to near premining conditions. The water quality of both the upper and lower aquifers is expected to be impacted as a result of dewatering and retort abandonment. The mixing of the higher quality upper aquifer water within the lower quality lower aquifer water would occur. Groundwater pollution could result from the flooding of abandoned retorts and backfilled mine workings.

**Vegetation** -- Under this alternative, loss of vegetation on 20,000 acres would occur and result in the temporary loss of 1,500 AUMs of forage for use by livestock and wildlife until disturbed areas are adequately reclaimed. This disturbance would occur mainly in the pinyon-juniper, sagebrush, and mountain browse vegetation types. Based on present data, no significant impacts would occur to threatened, endangered or rare plants.

**Wildlife** -- This alternative would result in the short-term loss of wildlife habitat and population declines on approximately 36,000 acres. The most important loss would be a mule deer population decline or mule deer carrying capacity loss of approximately 2,000 animals. Water used for project development would impact the quality and quantity of aquatic environments and decrease available surface water for wildlife use. Increases in local human populations would provide major primary and secondary impacts to the wildlife resource.

**Paleontological Resources** -- Impacts upon paleontological resources are not expected except for unknown and undiscovered resources affected by the sodium mine development and surface disturbing activities.

**Recreation** -- Increased populations (30 to 75 percent for Meeker) in the region may increase hunting pressure throughout the Piceance Basin thus decreasing hunting quality. On the proposed tracts, hunting of mule deer and cottontail would be displaced on and near the sodium mine. No other recreation uses would be affected.

**Social and Economics** -- Even without leasing, the communities of Rifle and Meeker would be experiencing rapid growth from the projects in the region that would already be causing "boom" conditions. The Town of Rangely would be receiving moderate growth impacts. Rifle would receive the most social impacts associated with boom towns. The typical influx of new construction workers creates a shortage of community facilities and services and an alienation with existing townspeople.

Rio Blanco and Garfield Counties would receive significant economic impacts from energy develop-

ments. Adverse effects include housing shortages, lack of "front-end" community services, capital development monies, new competition for existing work forces and local inflation. Benefits include increased employment opportunities and higher salaries. Other economic changes that may be considered beneficial by some and negative by others include the commercial/residential development of agricultural lands and land speculation.

**Transportation** -- An increase in haul truck traffic from the sodium mine would create some road damage on State Highway 13/789 between Rifle and Rio Blanco, and along Piceance Creek Road (County Road 5). The additional 180 haul trucks would raise use to 56 percent of the capacity of the state highway, and 24 percent of the capacity of the county road. Resulting annual repair costs by 1988 would be $222,000 to the State, and $218,000 to Rio Blanco County.

## C-11 Alternative

### Tract Description

This alternative examines the possibility of leasing only Tract C-11. This tract lies about eight miles east of Tract C-a and one mile west of Piceance Creek. Preliminary results of a recent survey indicate the tract contains 4,980.68 acres. The legal description is as follows:

**T1S, R97W, 6th PM, Rio Blanco County, Colorado**

Sec. 29: W1/2SW1/4

Sec. 30: All

Sec. 31: All

Sec. 32: W1/2W1/2

**T2S, R97W, 6th PM, Rio Blanco County, Colorado**

Sec. 5: W1/2W1/2

Sec. 6: All

Sec. 7: N1/2N1/2

Sec. 8: NW1/4NW1/4

**T1S, R98W, 6th PM, Rio Blanco County, Colorado**

Sec. 34: E1/2NE1/4

Sec. 35: All

Sec. 36: All

**T2S, R98W, 6th PM, Rio Blanco County, Colorado**

Sec. 1: All

Sec. 2: All

Sec. 3: Lots 5 and 6

Sec. 12: Lots 1 and 2

While irregularly shaped, this is a minable unit readily accessible from Piceance Creek Road via either Horse Draw (Sec. 29) or Ryan Gulch Road. This option provides excellent opportunities for plant and mine support facility siting, and for surface waste disposal into the head of Horse Draw or gulches tributary to Ryan Gulch. The irregularities along the west edge might complicate efficient mine layout appreciative of the NW/NE joint and fracture pattern. Leasing is currently complicated by the existing BLM/Bureau of Mines operating agreement that applies in whole or part to these sections. The existence of the Bureau of Mines shaft in Section 29 can be viewed as both a benefit or disadvantage to any future lessee. While it would provide any lessee with immediate access to the resource interval, the small shaft diameter (8 feet) limits its use to probably little more than initial resource sampling and possible secondary ventilation and emergency escape shaft for a commercial mine. A description of the mineral resources available on Tract C-11 is included in Chapter III, Geology.

### Summary of Impacts

Leasing of Tract C-11 would result in the following impacts. A more specific discussion is contained in Chapter IV, Environmental Consequences.

**Air Quality** -- Additional prototype lease impacts are predicted to be within all PSD increments and would not contribute to the predicted exceedances under any development alternative. Because the emission source elevation of Tract C-11 is higher than the source on Tract C-18, local ground level concentrations were predicted to be less on C-11.

**Geology** -- Under existing technologies, a certain portion of the resource will be rendered unrecoverable. Estimated recovery of oil shale resources under the direct mining and surface retort methodology would result in a permanent loss of the following resources as unmined or unproduced intervals, mine pillars, plant pillars, and process inefficiencies. Future improvements in mining and retorting efficiencies may significantly reduce these estimates of resource loss.

- 72 percent of the estimated 9.2 billion barrels of oil shale in place,
- 84 percent of the estimated 3.8 billion tons of nahcolite in place, and
- 84 percent of the estimated 0.92 billion tons of dawsonite in place.

Mine assisted in-situ recovery could result in a possible permanent loss of:

- 84 percent of the in place oil shale,
- 82.5 to 91.3 percent of the in place nahcolite, and
- 85.9 to 88.2 percent of the in place dawsonite.

With the true in-situ methodology a possible permanent loss of:

- 96 percent of the in place oil shale,
- 98 percent of the in place nahcolite, and
- 98 percent of the in place dawsonite

Resource recovery could be achieved using the following mining methods or combinations utilized in the following zones.

*Saline Zone* -- Direct, mine assisted in-situ or true in-situ mining may be utilized. Recovery should probably be highest by direct mining. Mine backfilling would enable greater resource recovery by allowing use of smaller pillars. Recovery by dissolution and surface recrystallization of saline minerals by true in-situ mining may be possible. Recovery utilizing true in-situ dissolution mining is presently unknown.

*Mahogany Zone* -- Direct mining with surface retorting or mine assisted in-situ processing may be used in this zone. Direct mining with backfilling should provide for the highest resource recovery.

*Leached Zone* -- Some method of true in-situ mining would be best suited to this zone due to the broken, brecciated rock and generally poor mining conditions. True in-situ would utilize the natural permeability of this zone.

**Alluvial Valleys, Floodplains, and Agricultural Lands** -- The water quantity and quality could be materially damaged or impacted (disturbing some or all of the 580 acres of the alluvial valley) in the Ryan Gulch, Horse Draw and ultimately the Piceance Creek alluvial valleys. Other impacts would be the result of spent shale and sodium mineral surface disposal into, and/or topsoil removal for top-dress of spent shale elsewhere as a result of the direct mining and surface retort, and the mine assisted in-situ methodologies. Impacts to the floodplains of Ryan Gulch and Horse Draw are dependent upon a detailed mine plan; avoidance is recommended to reduce impacts.

The agricultural impacts described for the No Action Alternative would occur under this alternative, also. However, an additional 910 to 1,150 acres of agricultural land would be permanently converted for urban expansion in nearby communities.

**Soils** -- The topsoil displacement and loss of soil productivity impacts described for the No Action Alternative would also occur under this alternative. These impacts would occur on an additional 1,200 to 3,200 acres of surface disturbance depending on the development scenario selected. Soil impacts would be similar in type and quantity for direct mining and mine assisted in-situ development because of the reclamation difficulties in achieving adequate soil stabilization on spent shale piles. Soil impacts from true in-situ would be less than for the other two development techniques. Leasing Tract C-11 could be more damaging to the soil resource than leasing Tract C-18 due to the greater number of acres of shallow, more erosive sideslope soils, alluvial valleys, and the predominance of south facing slopes present on Tract C-11.

**Hydrology** -- Approximately 8,000 acre ft/yr of water will be needed for a 50,000 bbls/day operation. An estimated eleven thousand acre ft/yr from mine dewatering will require surface disposal or reinjection. Approximately one-half of these figures would be necessary for a 25,000 bbls/day operation. According to modeling results, reinjection will not be possible on-tract and will have to be located off-tract, however, actual field tests could change these results.

Mine dewatering would cause water level declines on and adjacent to the lease tracts. Springs and wells receiving their water from the dewatering area could be impacted, depending upon their source. Groundwater contributions to Piceance and Yellow Creeks would be reduced as a result of mine dewatering.

Recovery of the groundwater and surface water systems (according to modeling results) may take as long as three to ten years, respectively, after mine dewatering ceases. Due to modeling inefficiencies, this period of recovery may be significantly longer or shorter. Upon abandonment, aquifer mixing may occur through shafts or subsurface retorts.

Leaching of toxic substances into the groundwater system may occur from abandoned retorts of the mine assisted in-situ and true in-situ methodologies. Leaching of spent shale backfill material may also occur in the direct mining and surface retort and mine assisted in-situ methodologies. Movement of these pollutants through the groundwater system may take centuries before they reach Piceance or

Yellow Creeks. Leaching of spent shale piles and process water disposal could also impact surface waters.

The White River could suffer a reduced flow of two percent for a 50,000 bbls/day operation and a one percent reduction for a 25,000 bbls/day operation. Salt loads to the White River could be reduced by as much as 3,000 tons per year.

A water augmentation plan would be required under state law to replace water consumptively used during mine dewatering. The State of Colorado requires that water rights be acquired for any water use. The state water courts are available to enjoin illegal water uses. A monitoring program would have to be established to determine impacted sources for both quantity and quality, so that mitigation can be recommended.

**Vegetation** -- The vegetation impacts described for the No Action Alternative are applicable to this alternative. These impacts would occur on an additional 1,200 to 3,200 acres and result in an additional short-term loss of 125 to 240 AUMs or six to eleven percent of the AUMs present on the allotment depending on the development scenario selected. The initial quantity of vegetation disturbed from mine assisted in-situ, direct mining and true in-situ development would be 1,200, 1,400 and 3,200 acres, respectively. However, assessment of reclamation potential indicates vegetation would be impacted more severely from mine assisted in-situ and direct mining development than from true in-situ development due to difficulties in establishing and maintaining vegetation over the long-term on spent shale piles. Additionally, leasing Tract C-11 would be more damaging to vegetation over the long-term than leasing Tract C-18 due to reclamation potential of soils. Rangeland projects would be adversely impacted to a greater degree under this alternative than from the C-18 alternative due to additional surface disturbance on vegetation manipulations and less distance between a water well and the area to be dewatered.

**Wildlife** -- In addition to the wildlife impacts described for the No Action Alternative, the following impacts would occur. Destruction or alteration of habitat would remove forage and cover available for wildlife use on an additional 1,200 to 3,200 acres. The severity of this impact over the long-term ranked from greatest to least impactive by development scenario is as follows: direct mining, mine assisted in-situ, true in-situ. This habitat loss would impact mule deer carrying capacity 41 percent more on Tract C-11 than for Tract C-18.

Human encroachment on-tract and secondary off-tract impacts would decrease habitat effectiveness for wildlife. These impacts would be 41 percent greater from leasing Tract C-11 than for leasing Tract C-18.

A significant increase in vehicle-related deer kills would occur. The number of deer killed would be 15 to 86 percent greater under the C-11 alternative than for the C-18 alternative depending on production level and stage of project operation.

Impacts to the aquatic resource in Piceance Creek and Yellow Creek should be insignificant if a water management plan is properly developed and implemented.

No significant impacts to threatened or endangered wildlife species would occur from leasing this tract. However, significant impacts may result from tract development to the Colorado River squawfish depending on the quantity and source of water required for mining.

**Cultural Resources** -- Impacts to cultural resources could occur if inadvertent destruction to previously undetected subsurface archaeological sites takes place during land disturbance associated with project development. Possible vandalism due to increased human activity would also be an unavoidable adverse impact.

**Paleontological Resources** -- Known fossil locations in the northeastern portion of the tract could be affected by earth disturbing or collecting activities. Impacts to important unknown or previously undiscovered paleontological resources could occur.

**Recreation** -- Hunting of mule deer and cottontail would be displaced on or near the tract site. Hunter-camping would also be displaced on and near the tract. Hunter access would be somewhat limited in the immediate area of development.

**Social and Economics** -- Under the low production rate (25,000 bbls/day) the town of Rangely would receive moderate social impacts, while Rifle and Meeker would receive severe impacts. Under the high production rate (50,000 bbls/day), Rangely would again receive moderate impacts, but Rifle and Meeker would sustain very severe effects. The towns of Silt, New Castle, Parachute, Battlement Mesa, Glenwood Springs, Carbondale and Grand Junction would not receive significant impacts.

Housing requirements under this alternative would increase 48 percent to 51 percent for the Town of Meeker, the most severely affected community. The next most affected town would be Rifle, with 35 percent to 43 percent increases in needs for housing.

Increases in crop sale losses would be 28 percent for Rio Blanco, 13 percent for Garfield and 10 percent for Mesa Counties.

Increased property and/or sales taxes would be $380,000 to $520,000 for Meeker and $720,000 to $970,000 for Rifle over projected revenues for 1988. Also, total employment for the three-county area would increase approximately 5 percent for the peak construction period of 1988.

**Transportation** -- This alternative would result in 220 trucks per day for the low production rate under the true in-situ scenario, or 440 trucks per day for a high production rate under the true in-situ scenario. The low and high production rate for direct or mine assisted methods would be 1,119 and 2,238 trucks per day for either road segment.

It becomes apparent that while there is a significant increase or difference in development scenarios, there is a dramatic difference between true in-situ and direct or mine assisted mining methods. This is because more products are recovered for direct mining and mine assisted in-situ than from true in-situ methods.

Traffic capacities would range from 61 to 100 percent for Highway 13/789 and from 26 to 70 percent for Piceance Creek Road (County Road 5). Increased costs would range from $270,000 to $2,760,000 for both the state and county roads.

**Net Energy Analysis** -- At the 25,000 bbl/day production rate, the mine assisted in-situ development scenario would be the most efficient recovery method, followed by true in-situ. Direct mining and surface retorting would be the least efficient. Under the 50,000 bbl/day production rate, mine assisted in-situ would be the most efficient with both the direct mining and surface retorting and the true in-situ scenarios the next most efficient. True in-situ efficiencies may either increase or decrease with technological refinements, due to the relatively recent technology of the method.

**Existing Rights** -- Mining activities on Tract C-11 could affect two gas line rights-of-way, three public water reserves, 15 oil and gas leases, and the Bureau of Mines' research facility at Horse Draw.

**Surface Reclamation and Solid Waste Disposal** -- Reclamation of surface disturbances would be essentially the same for the direct mining and surface retort, and the mine assisted in-situ retorting methodologies (provided backfilling of spent shale is done under the direct mining methodology).

Surface disposal will require intensive reclamation due to the leachability and possible toxicity of spent shale and the extent of shallow soils and sparse vegetation on the predominantly southern aspect of this tract. Surface disturbance of the tract will be increased if topsoil is borrowed from other areas to top-dress spent shale waste piles.

Depending on location and design of waste disposal piles, spent shale will eventually become exposed to the surface environment due to natural forces. Exposure of spent shale will result in degradation of surface water quality and decreases in the established vegetative portion of the previously reclaimed areas.

True in-situ technology has the most surface disturbance and potential for soil loss of any other methodology, however, reclamation will not be as difficult due to the absence of spent shale waste piles.

Establishment of shrub and tree species to mature growth forms will be difficult on spent shale piles due to the toxicity of spent shale and the shallow soils.

## C-18 Alternative

### Tract Description

This alternative examines the possibility of leasing only Tract C-18. This tract lies about six miles east of Tract C-a, immediately to the north of Tract C-11. The tract abuts the private lands along Yellow Creek to the northwest. Preliminary results from a recent survey indicate the tract contains 4,984.03 acres. The legal description is as follows:

**T1S, R98W, 6th PM, Rio Blanco County, Colorado**

Sec. 13: All

Sec. 14: All

Sec. 15: E1/2, SE1/4NW1/4, SW1/4

Sec. 22: E1/2, E1/2W1/2

Sec. 23: All

Sec. 24: All

Sec. 25: All

Sec. 26: All

Sec. 27: E1/2

This tract is a logical mining unit. The area contains excellent siting opportunities for plant and mine support sites, surface waste disposal areas in the upper reaches of three northward-trending gulches tributary to Yellow Creek, and access from the Piceance Creek road along Ryan Gulch and Yellow Creek, thence up the gulch through Sections 15 and 22. A description of the mineral resources available on Tract C-18 is included in Chapter III, Geology.

## Summary of Impacts

Leasing of Tract C-18 would result in the same impacts as described under C-11, with the following exceptions. For more details, see Chapter IV, Environmental Consequences.

**Air Quality** -- Although no exceedances of PSD increments are predicted from leasing Tract C-18 under any development alternative, emissions may impact air quality near Horse Draw and may contribute slightly to $NO_x$ impacts in Mt. Zirkel Wilderness under the modeled conditions.

**Geology** -- Estimated recovery of resources under the direct mining and surface retort methodology could result in a permanent loss of the following resources as unmined or unproduced intervals, mine pillars, plant pillars and process inefficiencies. Future improvements in mining and retorting efficiencies may significantly reduce these estimates of resource loss.

- 78 percent of the 10.2 billion barrels of oil shale in place,
- 86 percent of the 4.1 billion tons of nahcolite in place, and
- 83 percent of the 1 billion tons of dawsonite.

Mine assisted in-situ recovery could result in a possible permanent loss of:

- 89 percent of the in place oil shale,
- 90 percent of the in place nahcolite, and
- 92 percent of the in place dawsonite.

True in-situ recovery could result in a permanent loss of:

- 98 percent of the in place oil shale,
- 98 percent of the in place nahcolite, and
- 99 percent of the in place dawsonite.

**Alluvial Valleys, Floodplains, and Agricultural Lands** -- The water quality could be materially damaged or impacted in the Yellow Creek alluvial valley. Impacts would be caused by surface disposal resulting in leachates that could affect Yellow Creek.

Prediction of impacts to the floodplain of Yellow Creek would depend upon a detailed mine plan; avoidance is recommended to reduce impacts.

**Soils** -- These impacts would be the same as those described for C-11, except that less damages could occur because there are fewer shallow sideslope soils and more deep upland soils on C-18 that are more easily reclaimed.

**Vegetation** -- Approximately 0 to 15 fewer AUMs would be impacted over the short-term under this alternative than for the C-11 Alternative. However, over the long-term due to reclamation potential of soils, leasing Tract C-18 would be less damaging to vegetation than leasing Tract C-11. Rangeland projects would be impacted to a lesser degree under the C-18 Alternative than under the C-11 Alternative.

**Wildlife** -- The quantity of habitat destroyed or altered, the long-term impact ranking of development scenarios, aquatic impacts, and impacts to threatened or endangered species would be the same as those wildlife impacts described for the C-11 Alternative. However, the following impacts would be quantitatively less under the C-18 Alternative than for the C-11 Alternative:

- a 41 percent reduction in mule deer carrying capacity from habitat loss,
- a 41 percent reduction of on-tract human encroachment and secondary off-tract impacts, and
- a 15 to 86 percent reduction in vehicle-related deer kills.

**Cultural Resources** -- Impacts to cultural resources would be the same as under the C-11 Alternative, except that more disturbance to subsurface sites could occur since the density of known sites on Tract C-18 is higher than that on Tract C-11.

**Paleontological Resources** -- Known fossil locations in the northern portion of the tract could be affected by earth disturbing or collecting activities. Impacts to unknown and previously undiscovered paleontological resources could occur.

**Social and Economics** -- The same impacts would be felt as for C-11, except that housing requirements would only increase by 30 to 38 percent for Meeker and Rifle.

Increased property and/or sales taxes would be somewhat less than the C-11 Alternative because the sodium mine would be a separate tax entity under C-11 but not C-18. Increased taxes for Meeker would be $170,000 to $310,000 and $560,000 to $810,000 for Rifle. Total employment increases for the three county area would be about three percent for 1988; or two percent less than the C-11 Alternative.

**Transportation** -- This alternative would result in 40 trucks per day for a low production rate under the true in-situ scenario, and 260 per day for a high production rate. Using either direct or mine assisted methods, the figures would be 939 to 2,058 trucks per day for either road. The main difference be-

tween this alternative and C-11 would be the fact that if C-11 is selected, separate sodium production/trucking impacts would occur with true in-situ methods. If C-18 is chosen along with an in-situ method, the amount of minerals from other development would be reduced significantly.

Road capacities would range from 58 to 94 percent for the state highway and from 24 to 67 percent for the county road, depending on development scenarios and production rate. Repair costs would range from $50,000 per year to $2,300,000 per year with only a slight variation between Highway 13/789 and Piceance Creek Road due to some route variation from the sodium mine.

**Existing Rights** -- Mining activities on C-18 could affect two road rights-of-way, 11 oil and gas leases, and the existing sodium lease held by Wolf Ridge Corporation. Prior to any lease sale of this tract, an assignment agreement must be negotiated for the sodium minerals held by the current lessee, so that multiple mineral extraction can occur.

**Surface Reclamation and Solid Waste Disposal** -- Reclamation of C-18 would include all the items listed for the C-11 Alternative, with the following differences:

The predominantly northern exposure and gentle slopes would be more conducive to reclamation. Spent shale waste disposal piles would stay covered with soil for a longer period of time on C-18, and topsoil is more readily available for this purpose.

## Combined Alternative

This alternative examines the possibility of leasing both Tracts C-11 and C-18, or a total of some 9,964.71 acres. The tract descriptions (including legal descriptions) are included for C-11 and C-18 in the alternatives above.

Environmental impacts resulting from leasing both tracts are generally the cumulative total of the impacts described for C-11 and C-18, effectively doubling the impacts described for leasing either tract alone. Areas where this is extremely severe or where they are not a summation of impacts, are described below:

**Air Quality** -- Additional prototype lease impacts are predicted to be within all PSD increments and would not contribute to the predicted exceedances under any development alternative.

**Geology** -- Impacts to geology would be the same as those described for Tract C-11 with the exception of the following:

Estimated recovery of resources under the direct mining and surface retort methodology could result in a possible permanent loss of;

- 80 percent of the estimated 19.4 billion barrels of oil shale in place.
- 85.4 percent of the estimated 7.9 billion tons of nahcolite in place,
- 87 percent of the estimated 1.9 billion tons of dawsonite in place.

Mine assisted in-situ recovery could result in a permanent loss of;

- 86.6 percent of the in place oil shale,
- 90.4 percent of the in place nahcolite; and
- 91 percent of the in place dawsonite.

True in-situ recovery could result in a permanent loss of;

- 94.7 percent of the in place oil shale;
- 97 percent of the in place nahcolite; and
- 95 percent of the in place dawsonite.

**Hydrology** -- Impacts to hydrology systems from leasing both tracts would be as described under the C-11 and C-18 Alternatives, with the following exceptions.

Approximately 16,000 acre ft/yr of water would be required for development and 22,000 acre ft/yr would be required for surface or subsurface disposal from mine dewatering of a 100,000 bbls/day operation. A 50,000 bbls/day operation would involve approximately one-half less water than the 100,000 bbls/day operation.

Flow of the White River would be reduced by four percent at 100,000 bbls/day and two percent at 50,000 bbls/day. Total salt loads contributed to the White River at 100,000 bbls/day production would be reduced by approximately 6,130 tons/year. As a result of mine dewatering, Yellow Creek will become dry over 50 percent of the year (during summer months). Also, Piceance Creek would experience periods of no flow in the summer.

**Recreation** -- Hunting mule deer and cottontail would be displaced on and near the proposed tract sites.

Access would be somewhat limited in the immediate area of development for hunters. Hunting pressure would increase with population increases. Hunting opportunities may be denied to some hunters if the state decides to implement a permit system due to increased hunting pressure from the peak construction period.

**Social and Economics** -- If both tracts are developed, regardless of development scenario, the

Town of Rangely would receive severe social impacts and the towns of Rifle and Meeker would have impacts classified as very severe. Additionally, the towns of Silt, New Castle, Glenwood Springs and Carbondale would feel the effect for the Combined Alternative.

Housing requirements would be increased by 58 percent to 63 percent for Meeker and 50 percent to 58 percent for Rifle.

Increases in Crop Sales Losses for the Combined Alternative would be 29 percent for Rio Blanco County, 23 percent for Garfield County and 21 percent for Mesa County.

Increased property and/or sales taxes would be $560,000 to $840,000 for Meeker and $1,290,000 to $1,790,000 for Rifle, over revenues projected under the No Action Alternative. Total employment for the three-county area would increase approximately 8 percent for the peak construction period.

**Transportation** -- This alternative would result in 260 to 700 trucks per day for a low to high production rate comparison, using true in-situ methods. Using direct or mine assisted methods would result in 2,058 to 4,296 haul trucks per day.

Traffic capacities would range from 66 to 137 percent for the state highway and from 29 to 111 percent for the county road. Repair costs would range from $1,500,000 to $3,000,000 annually.

The most significant impacts to transportation would occur from either direct or mine assisted in-situ mining methods in steady-state production (1993) low or high development scenario of the Combined Alternative; and the high scenario for all three development alternatives.

**Noise** -- Significant noise increases would be produced by increased truck traffic along State Highway 13/789, between Rifle and Rio Blanco, and on County Road 5 between Rio Blanco and the tracts, for the high (100,000 bbls/day) production rate, using either the direct or mine assisted in-situ methods of mining. Noise levels would be increased from 69 to 78 db, at 50 feet from the highways, almost doubling the perceived noise level.

## Development Scenarios

Regardless of which tract(s) is (are) leased, the geotechnical setting is essentially the same permitting the use of essentially similar methods to recover shale oil and associated saline minerals. Possible development scenarios can be generally categorized as methods involving direct mining and surface retorting, mine assisted in-situ processing, and true in-situ. Tract development would probably begin in the Saline Zone with subsequent production from the upper zone shales, principally the Mahogany Zone, as the lower zone resources begin to play out, achieving a sustained production of 25,000 to 50,000 bbls/day of shale oil for each tract after 1993. For purposes of this analysis, mine life is assumed to be 30 years, beginning with lease sale in 1983. Actual mining will probably occur for a longer period up to 100 years or more, however, predictions of impacts beyond 30 years would be speculative at best.

### Direct Mining And Surface Retorting

Direct mining would require sinking of two or more large diameter shafts (15-30 feet) approximately 3,000 feet deep with one or more supplemental small diameter shafts for secondary ventilation utility lines, and emergency escape. From these shafts, up to several mine levels would be advanced across the tract probably along either a zone of bedded nahcolite or high grade (30 or more gallon/ton) oil shale. As these mine levels are advanced, one or more of several possible deep mining methods could be utilized to recover the bulk of the resource, including room-and-pillar, chamber-and-pillar, sublevel stoping, and crater retreat.

Room-and-pillar mining is the only method proven in oil shale, to date, at test mines along the southern edge of the Piceance Basin. This method involves mining out rooms of oil shale, leaving large blocks of resource in place to support the overburden. Generally, up to 60 percent of the resource across the mine interval can be recovered and moved by large trucks or conveyor systems to the production shaft for hoisting to the surface. However, over the entire breadth and thickness of the resource (for both C-11 and C-18), rock strength and efficiencies of currently available technology would probably limit overall recovery to not exceed 30 percent.

Chamber-and-pillar involves excavation of large rectangular rooms separated by long narrow pillars. Blast holes are drilled in a fan-shaped pattern to the side and above the mine level, charged, and blasted to create a rubble filled chamber. Large loading machines, trucks, and conveyors are used to move the rubble to the production shaft for hoisting to the surface.

Sublevel stoping and crater retreat are methods of mining out an interval of oil shale between upper and lower mine levels that may be up to several hundred feet apart. The intervening oil shale is

drilled and explosively rubblized. For sublevel stoping, large rectangular cavities are created, by drawing the rubble out through draw points feeding a haulage way mined below the lower blast hole drilling level. Cratering results in blasting off thick sections of oil shale between the mine levels and mucking out the rubble from the lower development level. Stoping has an overall extraction rate of 50 to 60 percent, while cratering can recover nearly all the shale between the mine levels.

For any of these methods to achieve maximum recovery and to stabilize the mine level so that overlying resources can be safely extracted with minimal impact on upper zone aquifers, it will be necessary to backfill mined out areas. Surface retorted oil shale can be mechanically or hydraulically back stowed. Removal of nahcolite will create sufficient excess void space so that virtually all of the surface processed shale can be backfilled at full production.

Direct mining will yield both bulk nahcolite during initial mining in the saline zone and combined oil shale and saline minerals during room and stope development. Bulk nahcolite will be further crushed on the surface and transported off-tract by truck. Remaining shale will be further crushed and nahcolite separated by optical/mechanical classification. The remaining shale can then be processed by one or more of surface retorting methods. Surface retort units can be directly heated by burning residual carbon on the shale fragments that form as the kerogen is broken down into oily gases and vapors; or indirectly heated by burning the carbon and/or process off-gas in external furnaces with the heat carried back to the retort chamber by a gaseous or solid working medium. Once retorted, the shale can be leached with a mild caustic water solution to dissolve out the alumina contained in the finely disseminated dawsonite. The now spent shale can be slurried or mechanically conveyed back to mined out areas to stabilize mine workings and minimize stratigraphic subsidence.

Estimated surface disturbance for mine shaft sites, surface facilities, and the mine support area is 200 acres. An additional 200 acres would be disturbed to construct the surface retort facilities. These disturbances would persist throughout the life of the mine. Approximately 1,000 acres would be required for surface waste disposal. However, only portions of this total acreage (approximately 200 acres) would ever be disturbed at one time since rehabilitation efforts would be implemented as soon as feasible to minimize erosion and fugitive dust emission. Surface facilities consist of permanent shafts encompassed by large cement head frames. A large retort system would be needed for processing extracted materials. Warehouses, offices, and lay down yards provide working area and equipment storage sites. Additional structures would be needed for ventilation fans, utility systems and water treatment plants.

## Mine Assisted In-Situ

Mine assisted in-situ could proceed on two principal schemes. The method currently being field tested by industry involves driving mine levels above and below the interval of shale to be retorted. These levels would probably be mined along either nahcolite rich zones or very rich oil shale. Then enough in place material equal to 20 to 40 percent of the volume of the shale rock between mine levels is mined out. Mined material would be hoisted to the surface for nahcolite separation and shipment, and surface oil shale retorting and alumina recovery. The intervening oil shale would then be drilled and explosively fragmented into large rubble filled chambers up to an acre in area. These rubble filled chambers are then heated at the top with special burners or externally heated gases and supplied with air and steam to initiate, sustain and control the rate of combustion to retort out the kerogen. Pyrolysis heat is drawn downward by differential ventilation pressure retorting the underlying oil shale. Oily gases and vapors tend to condense near the bottom of each chamber and are drawn to the surface for further separation through sealed mine shafts. In the Saline Zone, the rubble filled chambers could first be leached with water to dissolve out the nahcolite, then retorted. These burned out retort chambers could then be leached with a mild caustic solution to recover alumina.

A variation of this general scheme is to draw all the oil shales and nahcolite out of the rubble chambers to create large stopes, separate the nahcolite and crush the oil shale to uniform size underground. The crushed shale is put back into the stope and retorted and leached as described above to recover oil, gas and alumina.

Total surface disturbance for this scheme is less than required for Direct Mining and Surface Retorting due to smaller acreage requirements necessary for surface retort facilities and process waste disposal. An estimated 200 acres would be required for mine shaft sites, surface facilities, a mine support area, and the surface retort facility. Approximately 1,000 acres would be required for surface waste disposal piles.

Surface facilities for this technique would essentially be the same as required for Direct Mining and Surface Retorting with the exception of a smaller retort plant.

## True In-Situ

True in-situ processing is carried out by drilling closely spaced boreholes from the surface through the interval to be developed. Communication is then established between well points by hydraulic or explosive fracturing or by leaching away soluble minerals, such as nahcolite. Once communication is established, remaining nahcolite is dissolved by circulated water. The pregnant liquor is drawn to the surface through selected well points, salts are precipitated and marketed as caustic soda. The remaining oil shale is then retorted in place circulating superheated water or steam. The oily emulson is pumped to the surface for oil water separation.

Resulting surface disturbance is variable for this technique based on topography. Approximately 200 acres would be permanently disturbed at the plant site and product storage areas. Minimal acreage would be required for surface waste disposal. However, a large percentage of the tract surface (3,000 acres) would eventually be temporarily disturbed during land leveling operations for borehole drilling activities.

Surface facilities would be centralized around a stationary separation facility or a "semi-mobile" separation facility. These facilities would house oil and water separators, steam generators, and product handling systems. A traveling network of drill rigs would be required to drill boreholes and initiate underground extraction activities. Temporary surface pipelines would connect and transport products from the boreholes to the separator facility.

## Upper Zone Shale Recovery

Once the Saline Zone shales have been processed, it would be possible to recover oil and gas from the upper zone shales using either a direct mining method or mine assisted in-situ. The method selected would depend on zone thickness and ground conditions.

## Resource Requirements

For each of the development scenarios described above, associated resource needs have been identified that would apply to the rate of production, regardless of development technique. These resource requirements are described below.

### Employment

Based on available employment projections for existing oil shale operations, a rough correlation between daily oil production and required construction and operating work force can be made. For purposes of this analysis, it is assumed that steady state production employment will be achieved ten years after lease sale (1993), with a range of production from 25,000 bbls/day to 50,000 bbls/day for each tract by that year. Peak construction employment would occur approximately five years after lease sale (1988).

Given these assumptions, the following employment estimates can be assumed for each tract:

| Production (bbls/day) | Work Force | |
|---|---|---|
| | Peak Construction 1988 | Peak Operation 1993 |
| 25,000 | 1,700 | 1,125 |
| 50,000 | 2,200 | 1,400 |

If two tracts are leased, it is assumed that these numbers would roughly double, with the recognition that such an assumption may be a "worst case", since no two projects will be at exactly the same point in their development at the same time, and some employees with specific skills may be utilized by more than one project.

For both tracts, it is assumed that the work force would live in the following locations: Rio Blanco County-40 percent (Meeker-30 percent, Rangely-7 percent, elsewhere-3 percent), and Garfield County-60 percent (Rifle-50 percent, Silt-3 percent, Parachute-2 percent, elsewhere-5 percent).

### Product Transportation

At peak production it is anticipated that the following products will need to be transported out of each tract annually. The production estimates apply for both the direct mining and mine assisted in-situ scenarios. For the true in-situ scenario, only shale oil and caustic soda would be produced in the quantities shown below.

| Product | Production Rate | |
|---|---|---|
| | 25,000 bbls/day | 50,000 bbls/day |
| Shale Oil | 8,048,750 bbls | 16,097,500 bbls |
| Soda Ash | 831,250 tons | 1,662,500 tons |
| Alumina | 263,750 tons | 527,500 tons |
| Caustic Soda | 1,000,000 tons | 2,000,000 tons |
| Sodium Bicarbonate | 62,500 tons | 125,000 tons |
| Carbon Dioxide | 277,500 tons | 555,000 tons |
| Nahcolite I | 2,500,000 tons | 5,000,000 tons |
| Ammonia (liquid) | 49,755 tons | 98,550 tons |
| Sulfur | 27,375 tons | 54,750 tons |
| Coke | 91,250 tons | 182,500 tons |

Transporting these products to markets (typically hundreds of miles distant) or to existing common carrier dump points or rail sidings on existing roads will be a significant activity. During early scale-up phases of production, it will probably be feasible to transport oil products by truck. Shale oil could probably be taken to Rangely and piped from there, or to Rifle for shipment by rail while dry products and ammonia would probably be trucked to Rifle for rail shipment.

Transportation costs tend to dictate that most products be reduced to as low a volume and as high a value as practicable prior to transporting. Thus, most shale oil probably will be treated to the level of refinery feedstock prior to transporting. Pipelines appear to be the most practical method of moving shale oil and possibly ammonia. Sulfur, coke, and sodium and alumina minerals probably will be shipped by rail.

### Water Use

Water requirements are somewhat process-dependent, and many estimates to date for oil shale extraction are in the range of one to four barrels of water per barrel of shale oil produced. Thus the range in requirements for a 50,000 bbl/day plant would be from about 6.4 acre ft/day to 25.8 acre ft/day, or from about 2,300 to 9,300 acre ft/yr. Estimates for a 25,000 bbl/day plant would be approximately half this figure. Water requirements for handling and reclamation of processed shale make up a significant portion of the total water needed; given the range in possibilities of mining, backfilling, surface disposal of shale, and retorting, this portion of the water requirements could range from about 1/4 to more than 1/2 the total.

Other water uses include dust control, stack-gas scrubbing, revegetation, process steam and water, upgrading, mining and power generation. If mines are "wet", a significant amount of water will be removed as moist air by the mine ventilation system. Water requirements for sodium-aluminum extraction are not well known at this time, but would utilize a high percentage of recirculation and probably would be within the range of the above estimates.

In addition, municipal water use by the increased population will amount to some 100 gallons per day per person or about 11,000 acre ft/yr. per 10,000 population.

## Alternatives Considered But Eliminated

A number of other alternatives have been suggested, but were eliminated from detailed study. A brief description of these alternatives is presented below with the reasons for their elimination from further consideration. No other alternatives were presented that would have fewer apparent impacts, or that would better meet the Department of Interior's goals for the prototype program.

### Offering More Than Two Leases

The direction provided by the Assistant Secretary of the Interior for Land and Water Resources in November 1981 stated that BLM's oil shale program should include provisions for offering one or two tracts by early 1983 as part of the prototype leasing program. If feasible, these lease offerings should be designed specifically to provide opportunity for the concurrent development of oil shale and associated minerals in the Saline Zone, as well as other appropriate technologies. It is believed that these objectives can be met by offering one or two tracts under the prototype program. The need for more than two tracts has not been demonstrated.

## Offer Tracts Larger Than 5,120 Acres

New legislation is pending before the U.S. Congress to increase tract size, provide for off-tract disposal of spent shale, and allow for the holding of more than one lease by any one company or individual. Nevertheless, it has been assumed for purposes of this document that prototype leasing is subject to existing laws and regulations. The Mineral Leasing Act of 1920 limits tract size to 5,120 acres, the maximum considered in this Environmental Impact Statement.

## Analyze Areas Outside The Six Areas Offered

Five of the six areas offered for expressions of leasing interest were examined in the *1973 Prototype EIS*, and were subsequently identified in the White River Management Framework Plan as those areas where additional oil shale leasing should be offered first. The sixth area offered is a tract comprised of the two existing sodium leases in the basin. Since multiple resource recovery technology is one of the goals of this round of the prototype program, it was felt that offering any existing sodium leases for concurrent oil shale development was appropriate and within the discretion of the Secretary of Interior. In fact, three of the four expressions of leasing interest were for this sodium lease tract. It is felt that these lands were sufficient to meet the needs of the prototype oil shale program. While some interest was mentioned in areas outside the six tracts offered (including nearby Sodium Preference Right Lease Application tracts), the development technologies proposed can be used on the two tracts being analyzed. There would be no environmental advantage to offering tracts other than the two analyzed here.

## Analyze Tract II (a redelineation of Tract C-6 from the 1973 Environmental Impact Statement)

This tract was identified as being of secondary interest (or less desirable but still of interest) since the technologies recommended for the tract could be better employed on Tract C-11. It was determined that since C-11 was more desirable, and no new or different technologies were proposed for Tract II than for C-11, there was no need to offer both tracts for lease.

## Offer Only One Lease For Sale, But Open Two Tracts For Bidding

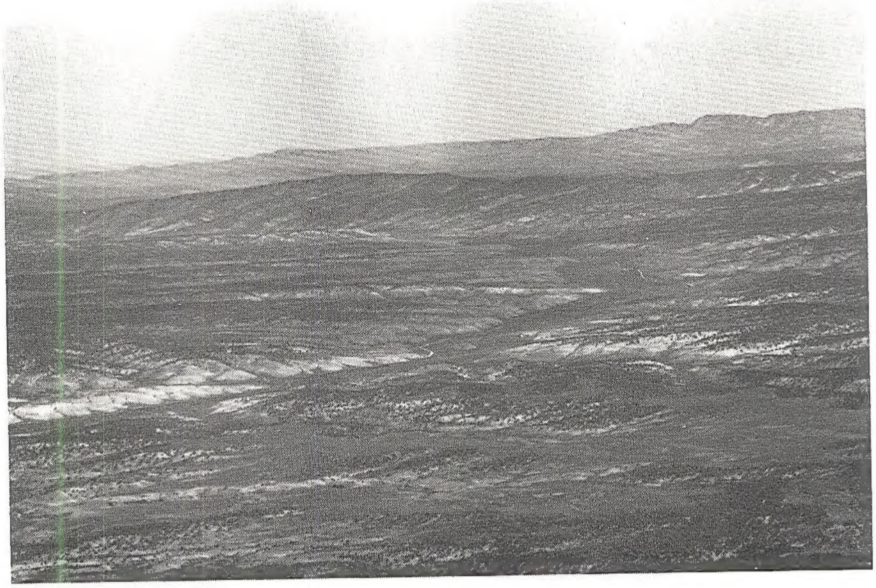
The idea behind this proposal would be to seek the highest bid for a single lease. Such an option could be considered by the Secretary of Interior in making his decision. This has not been addressed as a separate alternative since the result would be leasing either C-11 or C-18 and the impacts of both these alternatives are already being examined.

## Analyze The 1,320 Acres Of The Sodium Lease Tract West Of Yellow Creek

An expression of interest was received from the Nielson Resources Corporation for 1,320 acres of the sodium lease tract west of Yellow Creek for a multiple resource recovery process concurrent with oil shale development. Nielson is part owner of the Rock School Corporation which holds the sodium lease for this 1,320 acres. This tract has been eliminated from further consideration for two principal reasons: (1) it is only one-fourth the size of the maximum allowable lease acreage and could not be judged on the same competitive basis as the two larger tracts; and (2) it is not a "logically shaped" mining unit and is further complicated by a satellite parcel of 120 acres separated by private land along Yellow Creek with divided estate (surface - State of Colorado Division of Wildlife, mineral - Bell and Cross Cattle Company). However, it could potentially be added to adjoining lands to create a larger tract for lease under the proposed permanent oil shale leasing program sometime in the future.

## Delay or Phase Prototype Lease Sales Beyond The Proposed April 1983 Date

Currently, it is perceived that the only reason to consider such an alternative would be to wait for new technology to fully develop prior to leasing. However, it is felt that the development technologies proposed here are sufficiently evolved that such an alternative need not be considered. It is possible that there may be other reasons for delaying or phasing the lease sale. It is within the descretion of the decision maker to require such a delay and the Secretary may make this decision prior to announcing a lease sale.



Aerial view looking north across the northern portion of tract C-18 towards the lower reaches of Yellow Creek. June 10, 1982

View looking east across Yellow Creek to tract C-18.

## Preferred Alternative

Most of Tract C-18 is currently leased for sodium minerals to the Wolf Ridge Corporation. Since early 1982, BLM has been attempting to work out an agreement with Wolf Ridge Corporation whereby their interest in the sodium lease could be assigned to a successful bidder on C-18. BLM and Wolf Ridge have been unable to resolve these legal issues and, for this reason, C-18 will not be offered for lease at this time. The preferred alternative is to offer only Tract C-11 for lease.

**View looking northeast down Yellow Creek, (north of tract C-18).**

# CHAPTER III

## AFFECTED ENVIRONMENT

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# AFFECTED ENVIRONMENT

## AIR QUALITY

The existing air quality of the Piceance Basin is typical of undeveloped regions in the western United States; ambient pollutant levels are usually near or below the measurable limits. Notable exceptions in this region include high, short-term concentrations of total suspended particulates (TSP) (primarily wind blown dust), ozone ($O_3$), non-methane hydrocarbons (NMHC) and carbon monoxide (CO), especially in nearby towns. Locations vulnerable to decreasing air quality from extensive energy-related resource development include the immediate operation areas (coal mines, shale oil retorts, etc.), local population centers with their induced impacts, and distant areas which can be affected through long-range transport of pollutants.

National and state ambient air quality standards limit the total amounts of specific pollutants (CO, lead, nitrogen dioxide ($NO_2$), NMHC, $O_3$, sulfur dioxide ($SO_2$), and TSP). These standards were established to protect public health (primary standards) and public welfare (secondary standards). Areas which consistantly violate minimum standards because of man-caused activities are classified as Non-attainment Areas, and must implement a plan to reduce ambient levels below the maximum pollution standards (Table III-1). To protect areas not classified as Non-attainment, Congress established a system for the Prevention of Significant Deterioration (PSD) through the Clean Air Act Amendments of 1977.

Areas were classified by the additional amounts of TSP and $SO_2$ degradation which would be allowed. Class I areas, predominately National Parks and certain Wilderness Areas, have the greatest limitations; virtually any degradation would be significant. Areas where moderate, controlled growth can take place were designated as Class II. Class III areas are those areas which allow the greatest degree of impacts. Most of the study region is Class II - Grand Junction is a Non-attainment Area for TSP.

Class I areas closest to, and predominately downwind from the proposed lease sites are the Maroon Bells-Snowmass, Flat Tops, and Mount Zirkel Wilderness Areas. Although they have Class II PSD status, other areas of special concern include Dinosaur and Colorado National Monuments and the Raggeds Wilderness Area. These areas are shown in Figure III-1. Arches and Canyonlands National Parks are also Class I areas, but their geographic and meteorologic relationships to the proposed lease tracts make them less susceptible to air quality degradation.

The State of Colorado has also established standards to limit additional air quality deterioration by establishing $SO_2$ increments in state designated Category I areas. The standard is identical to the Federal PSD Class I $SO_2$ increments and applicable to the Colorado Class I areas listed above plus Dinosaur and Colorado National Monuments.

Background concentrations of CO, lead, $NO_2$, NMHC, $O_3$, $SO_2$ and TSP measured in the region are presented in Tables III-2 and III-3. Higher TSP levels would be expected near towns due to local combustion sources and traffic on unpaved roads, but the significant regional TSP concentrations are probably due to fugitive dust, primarily wind blown, which due to its greater mass settles relatively quickly. Since fugitive dust particulates are larger than those produced in combustion processes, they present a minimal inhalation health threat. The Environmental Protection Agency may alter the existing TSP regulations to reflect this difference by setting standards for particulates less than 10 to 15 microns in diameter, commonly called thoracic particulates and abbreviated $T_{15}$.

Ozone levels in the Rocky Mountain west are relatively high but of unknown origin. Elevated concentrations may be a result of long range transport from urban areas, subsidence of stratospheric ozone, or due to photochemical reactions with natural hydrocarbons. The true reason for elevated ozone values is uncertain, however. Occasional peak concentrations of CO and $SO_2$may be caused by combustion equipment near monitors.

Class I PSD regulations also address the potential for impacts to Air Quality Related Values (AQRV). These AQRV's include visibility, odors, and impacts to flora, fauna, soils, water, geologic and cultural structures. A possible source of impact to AQRV's is acid deposition. Tables III-4 and III-5 summarize the existing levels of visibility and acid deposition of the study region.

Visibility impacts can occur from atmospheric increases in small, light-scattering particles or increases in light absorbing gases (typically $NO_2$). Mechanisms of acid precipitation formation are currently under study. Preliminary results have correlated ambient sulfuric and nitric acids with combustion by-products (sulfates and nitrates).

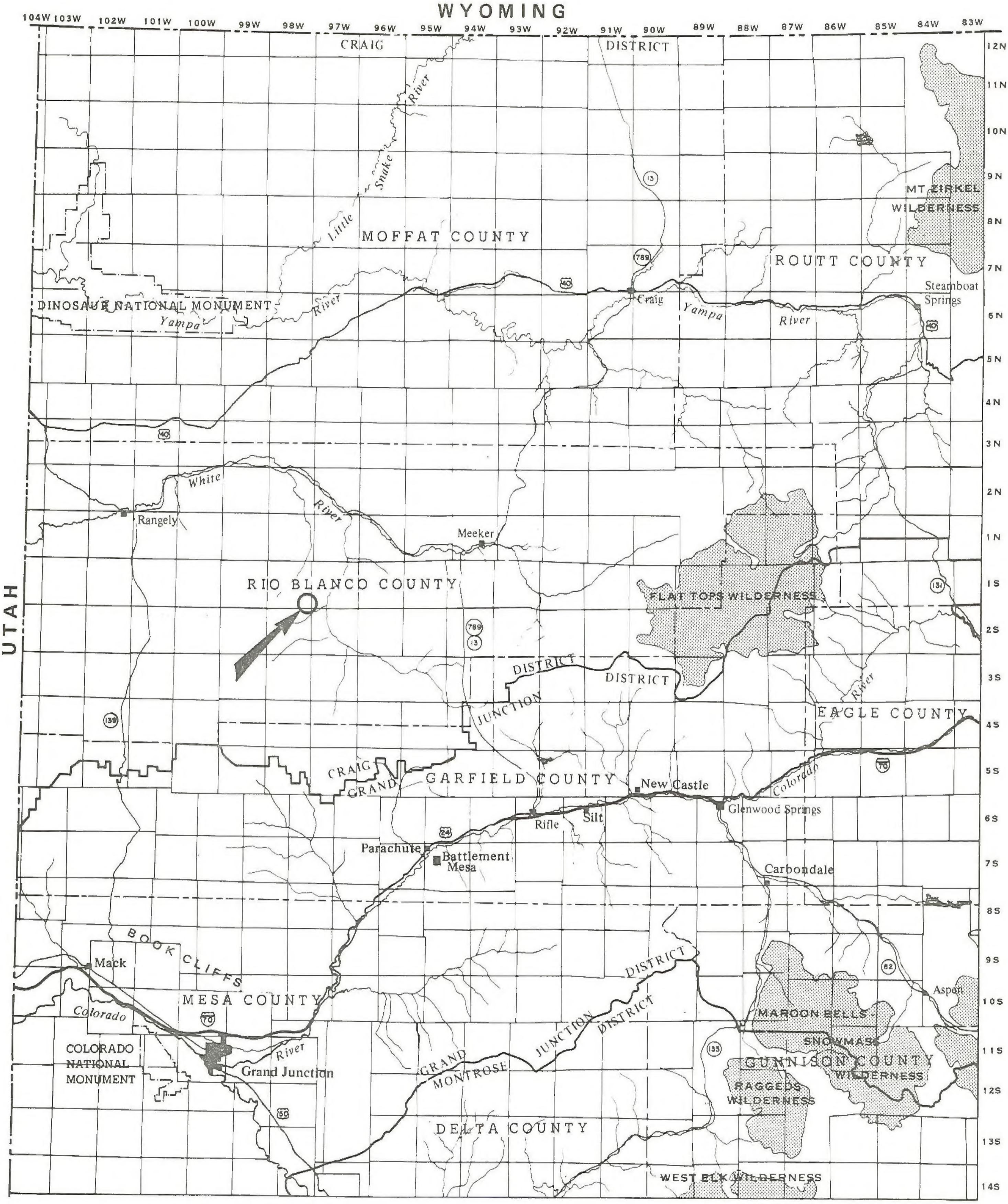
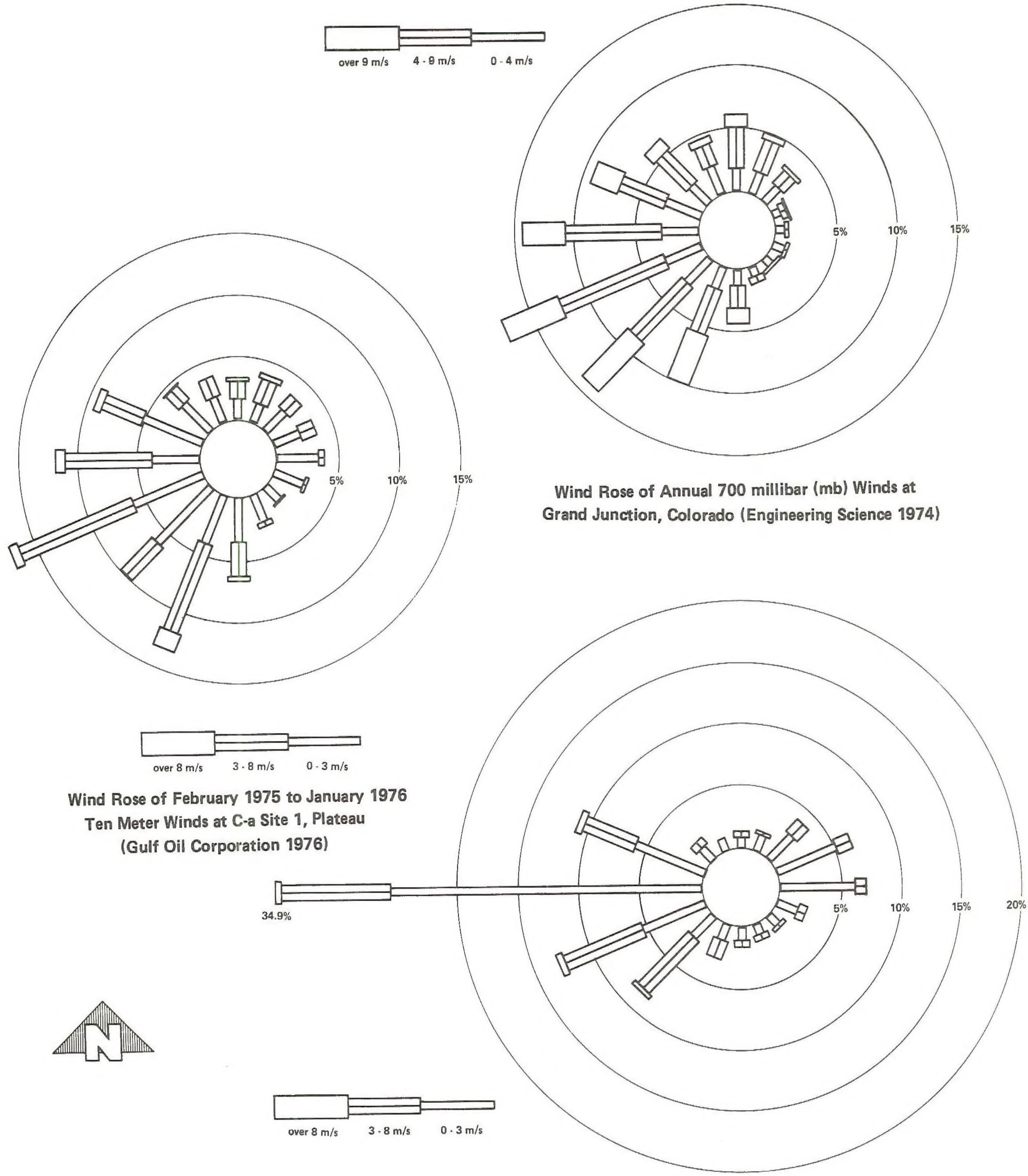



Figure III-1 Northwest Colorado Showing Approximate Location of Proposed Lease Tracts (arrow), Wilderness Areas, National Monuments in the Region, and Communities That May be Affected




Wind Rose of Annual 700 millibar (mb) Winds at Grand Junction, Colorado (Engineering Science 1974)

Wind Rose of February 1975 to January 1976 Ten Meter Winds at C-a Site 1, Plateau (Gulf Oil Corporation 1976)

Wind Rose of February 1975 to January 1976 Ten Meter Winds at C-a Site 3, Valley (Gulf Oil Corporation 1976)

Figure III-2

TABLE III-1
COLORADO AND FEDERAL AIR QUALITY STANDARDS

| | | Standards (Micrograms Per Cubic Meter) | | | | |
|---|---|---|---|---|---|---|
| | Averaging | Ambient b/ | | Increments c/ | | |
| Pollutant | Time a/ | Primary | Secondary | Class I/ Category I | Class II | Class III |
| Carbon monoxide | 8-hour | 10,000 | -- | -- | -- | -- |
| | 1-hour | 40,000 | -- | -- | -- | -- |
| Lead | Quarterly | 1.5 | -- | -- | -- | -- |
| Nitrogen Dioxide | Annually | 100 | -- | -- | -- | -- |
| Non-Methane Hydrocarbons d/ | 3-hour (0600-0900) | 160 | -- | -- | -- | -- |
| Ozone | 1-hour | 240 | -- | -- | -- | -- |
| Sulfur Dioxide | Annual | 80 | -- | 2 | 20 | 40 |
| | 24-hour | 365 | -- | 5 | 91 | 182 |
| | 3-hour | -- | 1,300 | 25 | 512 | 700 |
| Total Suspended Particulates | Annual | 75 | 60 | 5e/ | 19 | 37 |
| | 24-hour | 260 | 150 | 10 | 37 | 75 |

a/ Short term standards (those other than Annual and Quarterly) are not to be exceeded more than once each year.

b/ Ambient standards are the absolute maximum levels allowed to protect either public health (primary) or welfare (secondary).

c/ Prevention of Significant Deterioration standards are the maximum incremental increase levels allowed above the baseline amounts of pollutants in regions of clean air.

d/ The Non-Methane Hydrocarbon standard was established as a guide in evaluating attainment of the ozone standard.

e/ Total suspended particulate increments are not included in Colorado Category I standards.

TABLE III-2
SELECTED AMBIENT GASEOUS POLLUTANT CONCENTRATION DATA (MICROGRAMS PER CUBIC METER)

| | | Carbon Monoxide | | | | Nitrogen Dioxide | | Non-Methane Hydrocarbons | | | Ozone | | | Sulfur Dioxide | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Period | Avg. Time | Ann. Mean | 1st Max. | 2nd Max. | Ann. Mean | Max. | Ann. Mean | 1st 3 hr Max. | 2nd 3 hr Max. | Ann. Mean | 1st 1 hr Max. | 2nd 1 hr Max. | Avg. Time | Ann. Mean | 1st Max. | 2nd Max. |
| Cathedral Bluffs a/ | | | | | | | | | | | | | | | | | |
| #020 | 1981 | 1 | 100 | 1,800 | -- | 1.0 | 17 | -- | -- | -- | 65 | 161 | -- | 1 | 3.2 | 16 | -- |
| | 1980 | 1 | 78 | 1,700 | -- | 0.7 | 27 | -- | -- | -- | 59 | 122 | -- | 1 | 2.0 | 21 | -- |
| | 1979 | 1 | 217 | 2,300 | -- | 0.5 | 88 | -- | -- | -- | 52 | 192 | -- | 1 | 0.6 | 13 | -- |
| #023 | 1981 | 1 | 25 | 1,800 | -- | 2.1 | 45 | -- | -- | -- | 77 | 155 | 151 | 1 | 1.8 | 31 | -- |
| | 1980 | 1 | 92 | 3,800 | -- | 0.8 | 51 | -- | -- | -- | 75 | 154 | 130 | 1 | 1.1 | 21 | -- |
| | 1979 | 1 | 218 | 3,600 | -- | 1.6 | 38 | -- | -- | -- | 76 | 246 | 204 | 1 | 0.3 | 49 | -- |
| Chevron Tract b/ | | | | | | | | | | | | | | | | | |
| #E | 10/80-9/81 | 1 | 115 | 5,405 | -- | 3.8 | 66 | | | | 69 | 149 | -- | 1 | 2.6 | 21 | -- |
| Grand Junction, CO c/ | | | | | | | | | | | | | | | | | |
| | 1981 | 1 | -- | 18,400 | 14,375 | | | | | | | | | | | | |
| | | 8 | -- | 9,660 | 9,315 | | | | | | | | | | | | |
| | 1980 | 1 | -- | 16,100 | 13,225 | | | | | | | | | | | | |
| | | 8 | -- | 7,015 | 7,015 | | | | | | | | | | | | |
| Naval Oil Shale Reserve d/ | | | | | | | | | | | | | | | | | |
| | 6/81-9/81 | | | | | | | | | | -- | 265 | -- | 3 | -- | 118 | -- |
| | | | | | | | | | | | | | | 24 | -- | 69 | -- |
| | 6/80-9/80 | | | | | | | | | | -- | 206 | -- | 3 | -- | 44 | -- |
| | | | | | | | | | | | | | | 24 | -- | 13 | -- |
| Rio Blanco Tract e/ | | | | | | | | | | | | | | | | | |
| #1 | 12/79-11/80 | 1 | 575 | 1,035 | -- | | | | | | 98 | 157 | -- | 1 | 5.2 | 58 | -- |
| | 12/78-11/79 | 1 | 575 | 1,725 | -- | | | | | | 98 | 157 | -- | 1 | 26 | 26 | -- |
| | 12/77-11/78 | 1 | 575 | 575 | -- | | | | | | 118 | 176 | -- | 1 | 26 | 79 | -- |
| #3 | 12/79-11/80 | 1 | 575 | 575 | -- | | | | | | 78 | 137 | -- | 1 | 7.9 | 34 | -- |
| | 12/78-11/79 | 1 | -- | -- | -- | | | | | | 78 | 157 | -- | 1 | 26 | 236 | -- |
| | 12/77-11/78 | 1 | -- | -- | -- | | | | | | 78 | 137 | -- | 1 | 26 | 288 | -- |

Note: Underlined values indicate violation of Ambient Air Quality Standards.

a/ Source: Cathedral Bluffs Shale Oil Company, 1982,1981 and 1980.
b/ Source: Environmental Research & Technology, Inc, 1982.
c/ Source: Colorado Department of Health, 1982b and 1981.
d/ Source: TRW Energy Engineering Division, 1981.
e/ Source: Gulf Oil Corporation, 1981.

TABLE III-3
SELECTED PARTICULATE CONCENTRATION AND COMPOSITION DATA (MICROGRAMS PER CUBIC METER)

| Station Period | TSP # Obs | TSP Ann. Geo. Mean | TSP 1st 24 hr Max. | TSP 2nd 24 hr Max. | T15 # Obs | T15 Ann. Geo. Mean | T15 Max. | Sulfate # Obs | Sulfate Ann. Arth. Mean | Sulfate 24 hr Max. | Nitrate # Obs | Nitrate Ann. Arth. Mean | Nitrate 24 hr Max. | Lead # 1/4 | Lead Ann. Arth. Mean | Lead 1/4 Max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cathedral Bluffs a/ | | | | | | | | | | | | | | | | |
| Site 020 1981 | -- | 14 | 69 | -- | | | | | | | | | | | | |
| 1980 | -- | 10 | -- | -- | | | | | | | | | | | | |
| 1979 | -- | 16 | 63 | -- | | | | | | | | | | | | |
| Site 023 1981 | -- | 14 | 86 | -- | | | | | | | | | | | | |
| 1980 | -- | 11 | -- | -- | | | | | | | | | | | | |
| 1979 | -- | 16 | 81 | -- | | | | | | | | | | | | |
| Chevron b/ | | | | | | | | | | | | | | | | |
| Site A 10/80-9/81 | -- | 11 | 227 | $\underline{224}$ | -- | 4 | -- | | | | | | | | | |
| Site E 10/80-9/81 | -- | 21 | -- | -- | | | | | | | | | | | | |
| Colorado Nat'l Monument k/ | | | | | | | | | | | | | | | | |
| 1980 | 78 | 16 | 42 | 37 | | | | | | | | | | | | |
| 1979 | 86 | 15 | 67 | 62 | | | | | | | | | | | | |
| 1978 | 54 | 15 | 39 | 33 | | | | | | | | | | | | |
| Craig, Courthouse | | | | | | | | | | | | | | | | |
| 1981 | 83 | $\underline{87}$ | -- | $\underline{230}$ | | | | | | | | | | | | |
| 1980 c/d/e/ | 71 | $\underline{86}$ | 382 | $\underline{238}$ | | | | 69 | 5.9 | 11.2 | 69 | 1.7 | 5.9 | | | |
| 1979 | 41 | $\underline{93}$ | 206 | $\underline{170}$ | | | | 24 | 3.5 | 5.6 | 24 | 1.1 | 1.6 | | | |
| Glenwood Springs, Courthouse c/d/ | | | | | | | | | | | | | | | | |
| 1981 | 83 | $\underline{63}$ | -- | $\underline{198}$ | | | | | | | | | | | | |
| 1980 | 88 | $\underline{68}$ | 203 | $\underline{199}$ | | | | | | | | | | | | |
| 1979 | 85 | $\underline{57}$ | 188 | $\underline{173}$ | | | | | | | | | | | | |
| Grand Junction, Rood St. c/ | | | | | | | | | | | | | | | | |
| 1981 | 84 | $\underline{77}$ | -- | $\underline{232}$ | 65 | 57 | 194 | | | | | | | 4 | .70 | 1.0 |
| 1980 | 72 | $\underline{78}$ | -- | $\underline{144}$ | | | | 72 | 4.8 | 9.8 | 72 | 2.1 | 8.4 | 4 | .75 | 1.0 |
| 1979 | 83 | $\underline{82}$ | 183 | $\underline{176}$ | | | | 64 | 4.4 | 12.6 | 64 | 3.8 | 30.7 | 4 | 1.0 | 1.5 |
| Grand Valley, High School c/e/ | | | | | | | | | | | | | | | | |
| 1978 | 51 | 55 | 213 | $\underline{208}$ | | | | | | | | | | | | |
| 1977 | 35 | (52) | 334 | $\underline{217}$ | | | | | | | | | | | | |
| 1976 | 78 | $\underline{71}$ | 361 | $\underline{342}$ | | | | | | | | | | | | |
| Meeker, Courthouse | | | | | | | | | | | | | | | | |
| 1981 | 77 | 59 | -- | 134 | | | | | | | | | | | | |
| 1980 c/d/f/ | 70 | $\underline{66}$ | 212 | $\underline{171}$ | | | | | | | | | | | | |
| 1979 | -- | -- | -- | -- | | | | | | | | | | | | |
| Naval Oil Shale Reserve g/ | | | | | | | | | | | | | | | | |
| 6/81-9/81 | 14 | (24) | 37 | -- | 14 | 14 | 29 | | | | | | | -- | .01 | -- |
| 6/80-9/80 | -- | -- | 30 | -- | | | | | | | | | | -- | .01 | -- |
| Rangely, Water c/d/ Treatment Plant e/ | | | | | | | | | | | | | | | | |
| 1980 | 15 | (70) | 273 | $\underline{162}$ | | | | | | | | | | | | |
| 1979 | 22 | (130) | 342 | $\underline{324}$ | | | | | | | | | | | | |
| 1978 | 57 | 57 | 285 | $\underline{187}$ | | | | | | | | | | | | |
| Rifle, Third Ave c/ | | | | | | | | | | | | | | | | |
| 1981 | 80 | $\underline{99}$ | -- | $\underline{411}$ | | | | | | | | | | | | |
| 1980 d/e/ | 69 | $\underline{156}$ | 510 | $\underline{479}$ | | | | | | | | | | 2 | -- | 0.5 |
| 1979 | 83 | $\underline{128}$ | 694 | $\underline{660}$ | | | | 66 | 3.6 | 12.2 | 66 | 1.8 | 10.6 | 4 | .72 | 1.2 |
| Rio Blanco Tract h/ | | | | | | | | | | | | | | | | |
| Site 1 12/79-11/80 | -- | 13 | 61 | -- | | | | | | | | | | | | |
| 12/78-11/79 | -- | 11 | 303 | -- | | | | | | | | | | | | |
| 12/77-11/78 | -- | 14 | 59 | -- | | | | | | | | | | | | |
| 2/75-1/77 | -- | 9 | 211 | -- | | | | | | | | | | | | |
| Site 3 12/79-11/80 | -- | 18 | 96 | -- | | | | | | | | | | | | |
| 12/78-11/79 | -- | 21 | 192 | -- | | | | | | | | | | | | |
| 12/77-11/78 | -- | 26 | 160 | -- | | | | | | | | | | | | |
| 2/75-1/77 | -- | 15 | 281 | -- | | | | | | | | | | | | |
| Rio Blanco e/ | | | | | | | | | | | | | | | | |
| 1975 | -- | 13 | 111 | -- | | | | | | | | | | | | |
| 1973 | -- | 14 | 144 | -- | | | | | | | | | | | | |
| Steamboat Springs, | | | | | | | | | | | | | | | | |
| Sixth St. c/ | 32 | (155) | -- | $\underline{549}$ | | | | | | | | | | 2 | -- | 0.4 |
| 1980 | 68 | $\underline{134}$ | -- | $\underline{433}$ | | | | 64 | 6.3 | 16.4 | 64 | 2.0 | 7.6 | 4 | .38 | 0.5 |
| 1979 | 62 | $\underline{118}$ | 518 | $\underline{450}$ | | | | 51 | 4.0 | 10.9 | 51 | 1.9 | 6.7 | 3 | -- | 1.3 |
| Superior Tract i/ | | | | | | | | | | | | | | | | |
| 12/76-11/77 | -- | 40 | 647 | -- | | | | | | | | | | | .3 | j/ |

Note: Underlined values indicate violation of Ambient Air Quality Standards, parentheses indicate insufficient data to determine reliable average.

a/ Cathedral Bluffs Shale Oil Company, 1982, 1981 and 1980.
b/ Environmental Research & Technology, Inc., 1982.
c/ Colorado Department of Health, 1982b and 1981.
d/ Systems Applications Inc, 1982.
e/ Woodward-Clyde Consultants, 1981.
f/ Engineering-Science, Inc, 1974.
g/ TRW Energy Engineering Division, 1981.
h/ Gulf Oil Corporation, 1981.
i/ Bureau of Land Management, 1979.
j/ Concentration based on single sample.
k/ Lundy, 1982.

TABLE III-4
SELECTED VISUAL RANGE DATA (Km) e/

| Station | C-a/C-b a/ Photographic | Chevron b/ Nephelometer | Chevron b/ Radiometer | Colorado N.M Radiometer c/ | Dinosaur N.M. Radiometer c/ | Craig, CO c/ Radiometer |
|---|---|---|---|---|---|---|
| Spring 1975-76 | -/111/- | | | | | |
| Fall 1975-76 | -/147/- | | | | | |
| Spring 1978 | -/127/- | | | | | |
| Fall 1978 | -/129/- | | | | | |
| Spring 1979 | -/124/- | | | | | |
| Summer 1979 | | | | | 146/179/242 | |
| Fall 1979 | -/135/- | | | | 153/192/274 | |
| Winter 1980 | | | | | d/ | |
| Spring 1980 | -/126/- | | | e/ | d/ | 93/142/216 |
| Summer 1980 | | | | 130/176/238 | 95/150/238 | 104/136/179 |
| Fall 1980 | -/150/- | | | 145/197/267 | 146/203/283 | 96/144/217 |
| Winter 1981 | | -/344/- | -/180/- | 145/215/317 | d/ | 113/170/258 |
| Spring 1981 | -/135/- | -/200/- | -/210/- | d/ | d/ | 107/166/257 |
| Summer 1981 | | -/250/- | -/170/- | 120/166/229 | 95/135/192 | 94/140/209 |
| Fall 1981 | -/140/- | -/200/- | -/195/- | d/ | | 98/154/241 |

a/ Source: Gulf, 1981, and Stevens, 1982. Measurements taken during intensive studies each spring and fall at an elevation of nearly 2100 m. Average of several targets.

b/ Source: Vertstuyft, 1982. Radiometer Measurements taken of Flat Tops Wilderness; nephelometer at an elevation of nearly 2600 m. Data is averaged quarterly (i.e., winter is January through March, etc.)

c/ John Muir Institute, n.d. Measurements are taken daily of several targets and adjusted to a standard visual range elevation of 1550 m.

d/ Insufficient data.

e/ Data is presented as 10th/50th/90th percentile values

TABLE III-5

SELECTED ACID DEPOSITION DATA (pH)

| | Craig, CO | | | | Douglas Pass | | | | Grand Mesa | | | | Marvine Ranch | | | | Naval oil Shale Res. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Season | # Obs | Mean | 1st Min | 2nd Min | # Obs | Mean | 1st Min | 2nd Min | # Obs | Mean | 1st Min | 2nd Min | # Obs | Mean | 1st Min | 2nd Min | # Obs | Mean | 1st Min | 2nd Min |
| Spring 1979 | 2 | 5.21 | 5.00 | 5.63 | | | | | | | | | | | | | | | | |
| Summer 1979 | 7 | 4.89 | 4.48 | 4.65 | | | | | | | | | | | | | | | | |
| Fall 1979 | 10 | 4.79 | 4.23 | 4.65 | | | | | | | | | | | | | | | | |
| Winter 1980/81 | 15 | 5.10 | 4.74 | 4.81 | 4 | 5.92 | 5.50 | 6.09 | 12 | 5.21 | 4.52 | 5.00 | 16 | 5.25 | 4.60 | 4.72 | 2 | 5.72 | 5.64 | 5.81 |
| Spring 1980/81 | 26 | 4.90 | 4.30 | 4.33 | 6 | 5.14 | 4.75 | 5.18 | 2 | 5.51 | 5.27 | 6.13 | 7 | 5.59 | 4.86 | 5.47 | 1 | 4.93 | – | – |
| Summer 1980/81 | 21 | 4.88 | 4.32 | 4.45 | 4 | 4.63 | 4.41 | 4.50 | 1 | 5.26 | – | – | 7 | 4.81 | 4.49 | 4.74 | 3 | 5.15 | 5.03 | 5.05 |
| Fall 1980/81 | 17 | 5.03 | 4.62 | 4.70 | 3 | 5.66 | 5.40 | 5.60 | 2 | 5.13 | 4.88 | 5.82 | 5 | 4.86 | 4.39 | 4.85 | 3 | 5.09 | 4.78 | 5.14 |
| Winter 1982 | 6 | 5.43 | 5.04 | 5.20 | | | | | | | | | | | | | | | | |

Sources: National Atmospheric Deposition Program n.d., and Turk 1982.

TABLE III-6
FREQUENCY OF STABILITY CLASSES AT 500 METERS ABOVE GROUND LEVEL

| Station/Season | | Morning (percent) Unstable | Morning Neutral | Morning Stable | Afternoon (percent) Unstable | Afternoon Neutral | Afternoon Stable |
|---|---|---|---|---|---|---|---|
| Cathedral Bluffs Tract | | | | | | | |
| | Annual | 10 | 55 | 34 | 19 | 55 | 27 |
| | Spring | 11 | 61 | 28 | 34 | 54 | 12 |
| | Summer | 13 | 51 | 36 | 45 | 32 | 23 |
| | Fall | 10 | 61 | 29 | 17 | 63 | 21 |
| | Winter | 2 | 48 | 50 | 6 | 69 | 25 |
| Craig | Annual | 2 | 39 | 60 | 16 | 64 | 20 |
| | Spring | 5 | 56 | 39 | 31 | 54 | 14 |
| | Summer | 0 | 21 | 80 | 14 | 66 | 20 |
| | Fall | 2 | 37 | 61 | 13 | 69 | 18 |
| | Winter | 0 | 43 | 57 | 6 | 65 | 29 |
| Grand Junction | Annual | 2 | 52 | 46 | 1 | 84 | 15 |
| | Spring | 1 | 68 | 31 | 0 | 96 | 3 |
| | Summer | 0 | 57 | 43 | 0 | 98 | 2 |
| | Fall | 1 | 49 | 50 | 0 | 91 | 9 |
| | Winter | 6 | 33 | 62 | 3 | 51 | 47 |

Source: Systems Applications, Inc. 1982. Percentages may not add to 100 percent due to rounding errors.

TABLE III-7
SELECTED MIXING LAYER HEIGHT DATA

| Station/Season | Morning (Meters above ground level) | Afternoon (Meters above ground level) |
|---|---|---|
| Grand Junction a/ | | |
| Annual | 384 | 2,600 |
| Spring | 628 | 3,166 |
| Summer | 307 | 3,940 |
| Fall | 273 | 2,133 |
| Winter | 329 | 1,160 |
| Rio Blanco Tract b/ | | |
| Annual | 450 | -- |
| Spring | 935 | -- |
| Summer | 179 | -- |
| Fall | 196 | -- |
| Winter | 290 | 850 |

a/ Source: Systems Applications, Inc. 1982
b/ Source: Gulf Oil Corporation 1976

In summary, annual average concentrations (micrograms per cubic meter) in rural regions of the study area range as follows: TSP 10 to 40, $SO_2$ 0.3 to 3, and $NO_2$ 2 to 30. Twenty-four hour average values range: 80 to 130 for TSP and 50 to 130 for $SO_2$. One hour average concentrations of ozone and CO range from 118 to 160 and 1000 to 2300 respectively. Average lead concentrations vary from 0.05 to 0.06 quarterly. Developed areas have nearly the same values with the following exceptions: average TSP concentrations range from 80 to 130 annually and 115 to 440 for 24 hours; $NO_2$ annual average concentrations range from 2 to 50; average one hour CO values may reach 20,700; and urban lead averages vary from 0.5 to 0.8 quarterly. Recent measured extremes appear in Tables III-2 and III-3.

## CLIMATE

Piceance Basin is located in a semi-arid, continental climate regime, characterized by dry air, sunny days, clear nights, little precipitation, extreme evaporation, and large diurnal temperature changes. Because of the surrounding mountains, low pressure storm systems tend to pass around the region, whereas high pressure cells stagnate, blocked by the Rocky Mountains, resulting in moderate temperatures and abundant sunshine. The region's complex topography causes considerable variation in site-specific temperature, precipitation, and winds, but these influences are less on the plateaus than down in the valleys. Severe weather conditions such as tornadoes, floods, damaging hail, winds and thunderstorms are rare.

Temperatures vary mostly with elevation, and to a lesser extent, local microclimate. Generally, summer temperatures range from lows of 6°C (45°F) to highs of 30°C (85°F). Winter temperatures range from -15°C (5°F) to 2°C (35°F). Extreme temperatures may fall as low as -40°C (-40°F) or up to 38°C (100°F). Frost-free periods vary from year to year and by location, but tend to range from 60 to 150 days.

Annual precipitation in the Piceance Basin is highly variable; ranging from 20 to 60 cm (8 to 24 inches), with slightly more than half of the moisture coming from scattered spring and late summer thundershowers. Snowfall amounts vary from 64 to 380 cm (25 to 150 inches); snowcover is commonly redistributed by wind. At lower elevations, limited data indicate evaporation exceeds precipitation, with the driest conditions occurring in mid-summer.

Upper-level winds predominate from the southwest, but surface wind patterns are almost entirely dependent on local terrain and ground cover. Persistant winds with little directional modification are found on the plateaus, but winds in valleys show strong drainage influences (Figure III-2). Synoptic (pressure gradient) winds may be forced around hills or channeled through valleys, but if there are no strong gradient flows, diurnal upslope/downslope winds predominate.

Upslope winds usually occur on sunny mornings when the air at higher elevations heats rapidly and rises. Downslope winds occur when the air near the ground cools, becomes dense, and sinks downward along drainages. In Piceance Basin, downslope winds are common and stronger than their upslope counterparts.

Air basins have been defined based on these drainage winds, indicating areas of similar atmospheric flow, topographic influence and general dispersion potential. Under stable conditions, pollutants tend to collect and concentrate in an air basin until regional synoptic winds disperse the air between basins. Generally, Piceance Creek downslope winds flow into the Craig Air Basin in the north and the Roan or Parachute Creek downslope winds flow south into the Colorado River Basin (PEDCO Environmental 1981).

The extent that vertical and horizontal mixing will take place is related to the atmospheric stability and mixing height. Distributions of these factors from selected locations near the study area are presented in Tables III-6 and III-7. Unstable conditions occur under conditions of strong surface heating, typical of summer afternoons, producing upslope winds. Neutral conditions reflect a breezy, well-mixed atmosphere. Stable conditions are enhanced by rapid radiative cooling and downslope drainage, producing the least amount of dispersion. Inversions may exist under stable conditions, trapping pollutants within a certain layer of air. In the Piceance Basin, moderate inversions are formed during the summer in the evening and dissipate at dawn.

Winter inversions are stronger and last longer; an episode lasting three to six days may be expected (Bureau of Land Management 1976). Inversions are enhanced by weak pressure gradients, cold clear nights, snowcover and lower elevations.

## GEOLOGY AND MINERAL ACTIVITY

The following is a discussion of the geology of Tracts C-11 and C-18, and the mineral resources estimated to occur under each tract. Mineral devel-

opment activity is currently taking place in the area as described in Chapter II, No Action Alternative.

## Structural Geology of Tracts C-11 and C-18

The regional dip is to the north in the eastern part and to the northwest in the western part of the area at a rate of 150 feet per mile. Additional information on the structural geology of the area is included in the *1973 Prototype EIS*.

Figure III-3 presents a general stratigraphic column of both Tracts C-11 and C-18. Figure III-4 is a geologic cross section across Tract C-11 and areas to the west (see Figure III-5 for location of the cross-section). Core hole MMC-IRI No. 1 is located near the southern boundary of Tract C-18. Core hole Square S No. 1 is located one mile east of the east boundary of the tract. Figure III-5a is a map of the surface geology in the vicinity of the tracts. Figure III-6 is a geologic cross section through the southeast quadrant of Tract C-18 (see Figure III-5 for location of the cross-section).

Figure III-5a shows the relationship of the South Rangely Syncline and Dudley Bluffs Graben to the proposed lease tracts. The structural disturbance of surface outcrops is minimal and difficult to detect (Multi Minerals Corporation 1981). No faults are known to transect the proposed leases. The Dudley Bluffs Graben approaches the lease tracts from the southeast (Figure III-5a) but according to Duncan (1976) the fault system dies out near the southeast corner of Tract C-11. The most prominent joint set throughout the Basin strikes west-northwest with a secondary joint set striking north-northeast. There is a strong correlation between major fault systems like the Dudley Bluffs Graben and the principal joint sets and fracture patterns.

The Uinta Formation stratigraphically overlies the Green River Formation. It varies from 1,000 feet to 1,200 feet in thickness and is composed of four major sandstone-siltstone units interbedded with three thin (30 foot thick) marlstone tongues of the Green River Formation. Since the Uinta Formation contains no economic resources, it exists as overburden to the oil-rich Parachute Creek Member of the Green River Formation.

The Parachute Creek Member has been subdivided into alternating units of lean to relatively rich kerogen-bearing strata. The Parachute Creek is also subdivided on the basis of saline minerals. A dissolution surface divides the Parachute Creek Member into two major zones, the leached zone and the saline zone according to the presence or absence of dawsonite, nahcolite, and halite. The dissolution surface (see Figures III-4 and III-6) occurs in the L-5 oil shale zone in the central part of Tract C-18 but drops stratigraphically to the base of the R-5 zone in the southeast part of Tract C-11. This dissolution surface marks the lowest penetration of groundwater into the Parachute Creek Member.

The leached zone, the interval above the dissolution surface and below the upper two thirds of the oil shale rich Mahogany Zone varies from 400 to 600 feet thick and contains rich oil shale beds as well as cavities and collapsed breccias from which nahcolite and halite have been dissolved and subsequently crushed by overburden weight. Below the dissolution surface, the saline zone ranges from 500 to 1,200 feet thick, with the thickest interval found in the northeast quadrant of Tract C-18. The saline zone is composed of coarse aggregate to disseminated nahcolite, bedded halite and nahcolite interbedded with oil shales. The lower stratigraphic boundary of the saline zone is located approximately 50 feet above the Garden Gulch Member of the Green River Formation.

The Garden Gulch Member averages 150 feet in thickness across the area. It consists mainly of lean, silty marlstone and non-nahcolite bearing oil shale. The base of the Garden Gulch Member marks the base of the oil shale of economic interest (Multi Mineral Corporation 1981).

Dawsonite, which is insoluable in groundwater, is contained in the lower Parachute Creek Member. The mineral has a greater lateral and vertical distribution than nahcolite. It occurs as minute crystals, 5 microns or less in size, disseminated throughout the oil shale matrix in the saline zone. Over short intervals, dawsonite may compose as much as 25 percent of the rock (Smith and Milton 1966), but it usually comprises less than 10 percent (Young and Smith 1970).

Dawsonite mining and recovery would probably be limited to zones containing rich beds or abundant nodules of nahcolite. The two minerals would be simultaneously extracted with the oil shale from the saline zone by direct mining or be dissolved and recrystallized by in-situ mining and processing as described in the Chapter II, Development Scenarios.

## Mineral Resources of Tract C-11

The proposed Tract C-11 lies over the axis of the South Rangely syncline. The syncline trends northwestward across the tract. The Mahogany Zone dips at approximately 100 feet per mile northeastward south of the syncline's axis and south-

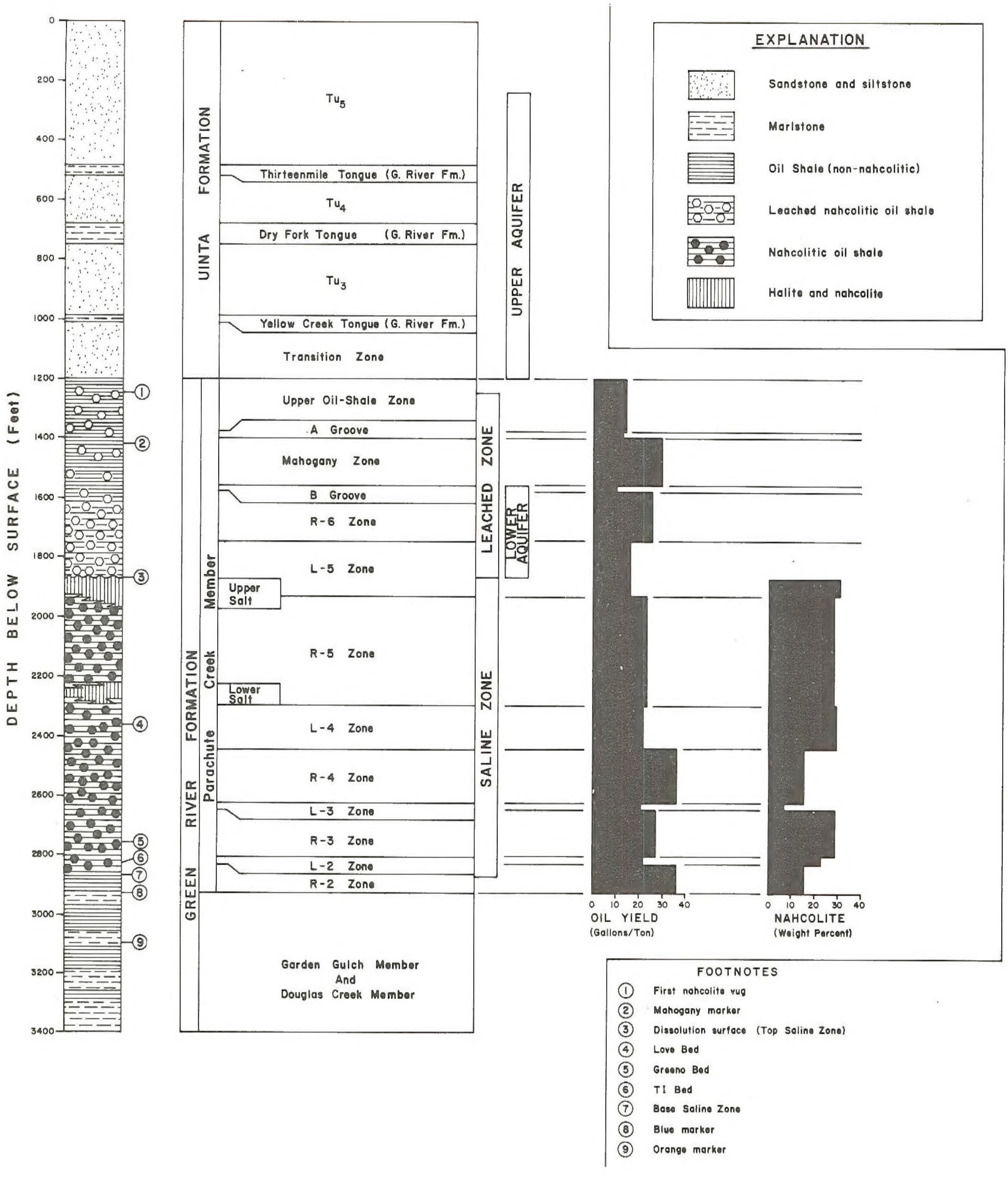



**Figure III-3 Detailed Stratigraphic Column of Uinta Formation and Upper Green River Formation for Both Tracts C-11 and C-18 (Multi Mineral Corporation 1981)**

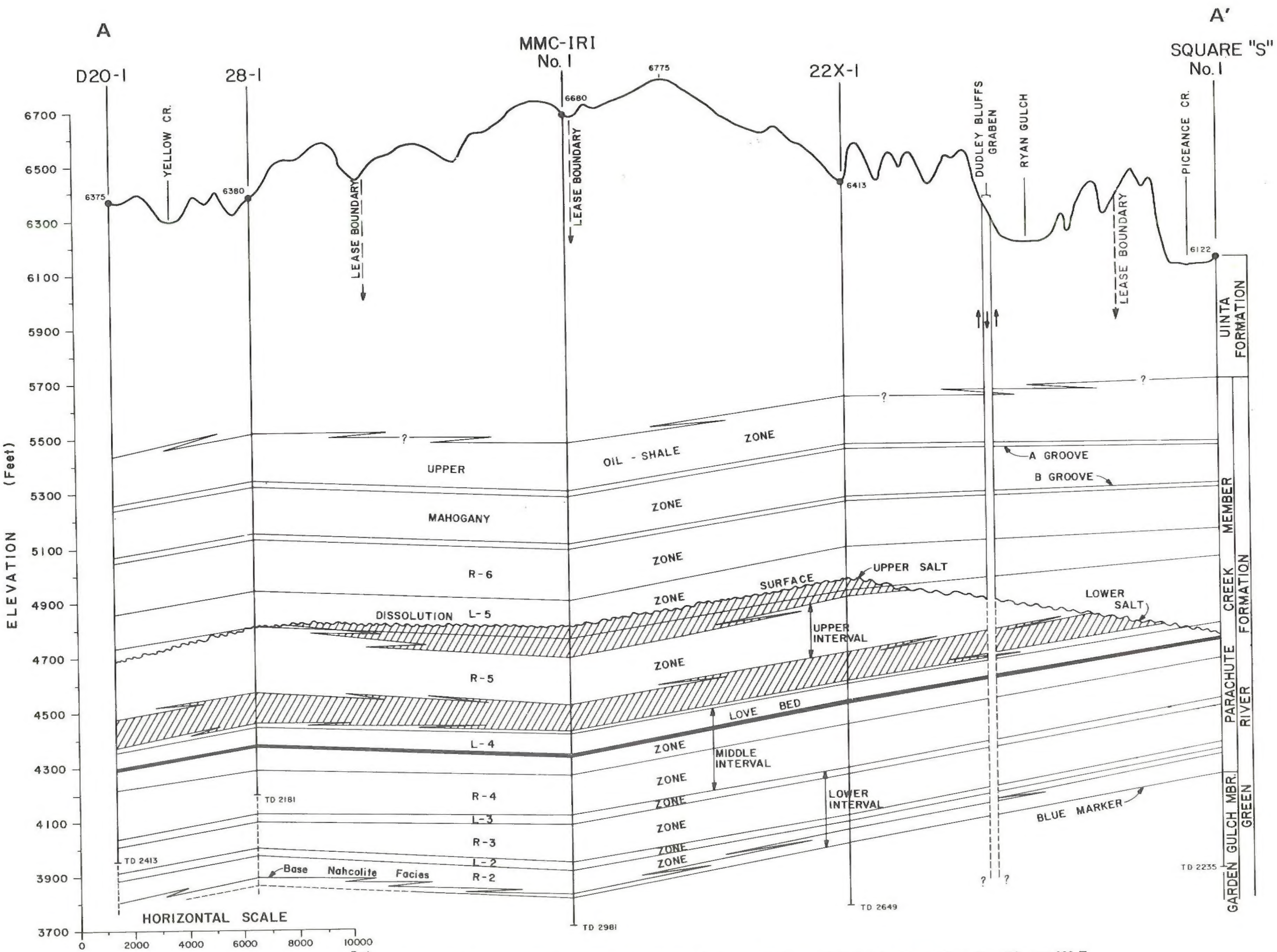



Figure III-4 Structural Cross Section A-A' Through Tract C-11. For Location See Figure III-5 (Multi Mineral Corporation 1981)

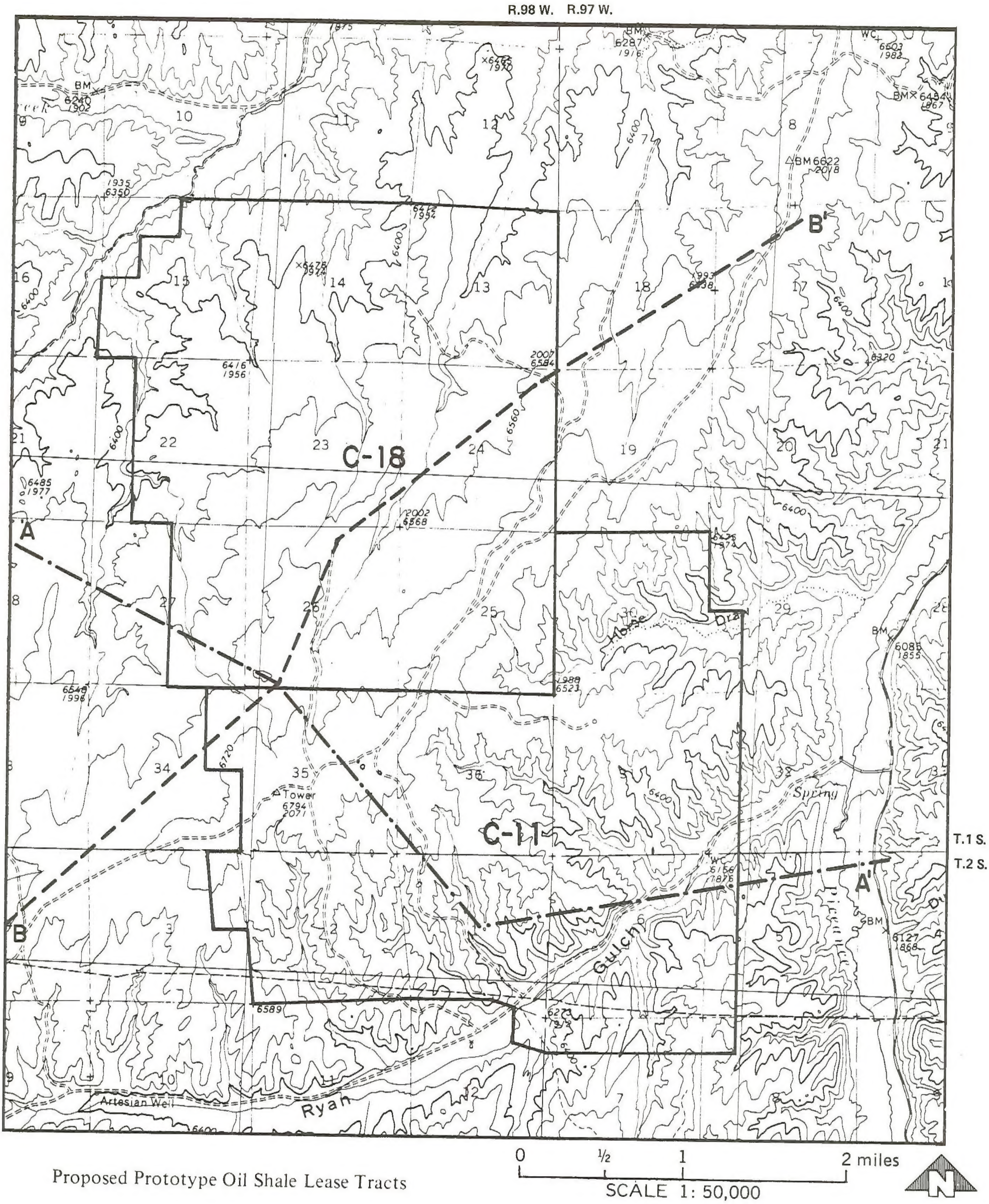



**Figure III-5 Location of Stratigraphic Cross Sections. Lines A-A' and B-B' Correspond to Figures III-4 and III-6 (Multi Mineral Corporation 1981)**

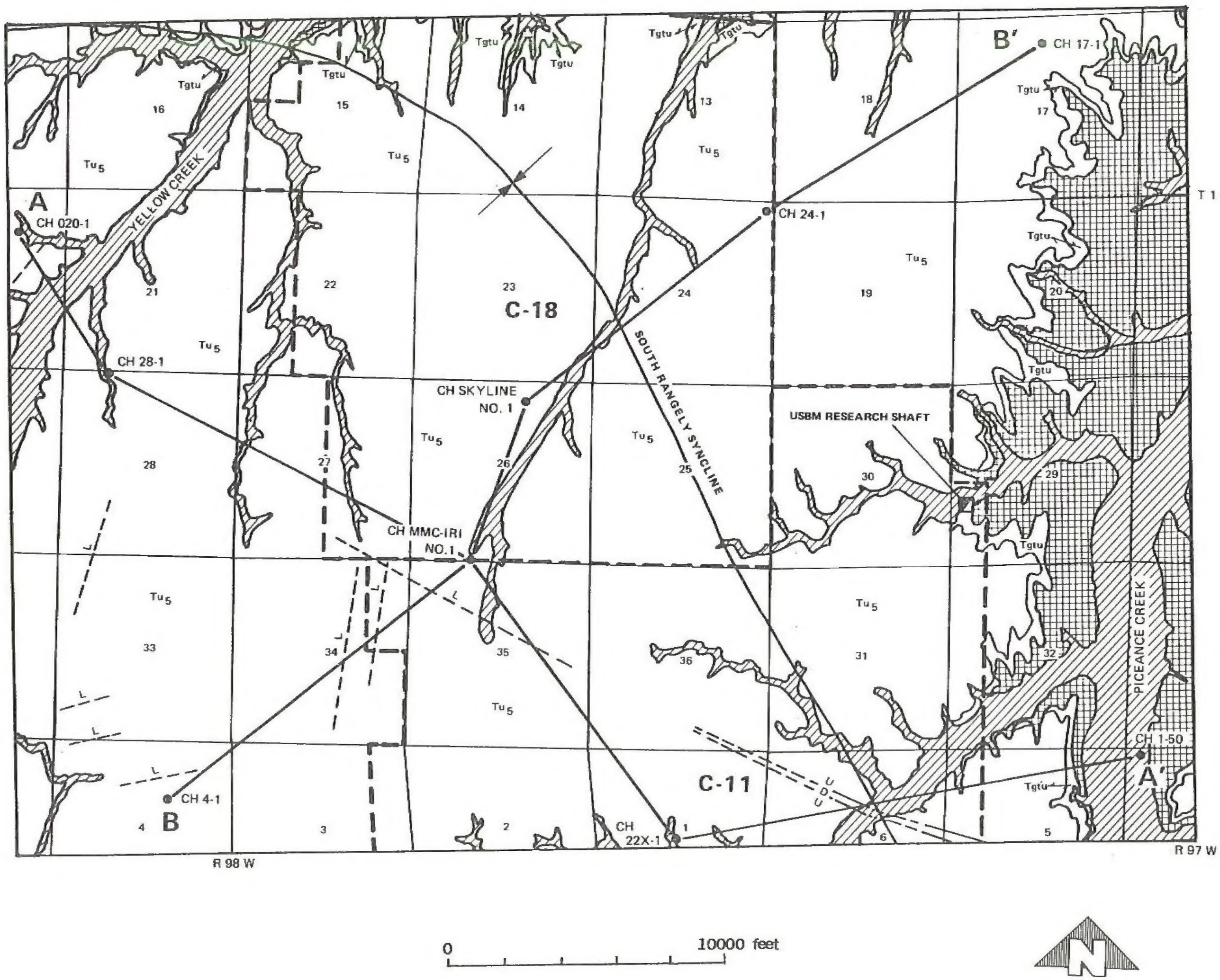



Figure III-5a Surface Geologic Map of the Lease Area (adapted from Multi Mineral Corp., 1981)

## EXPLANATION

### STRATIGRAPHY OF MAP UNITS

| | | | |
|---|---|---|---|
| | Qal | HOLOCENE | QUATERNARY |
| | $TU_5$ | EOCENE | TERTIARY |
| | Tgtu | | |
| | $Tu_4$ | | |

### DESCRIPTION OF UNITS

Qal ALLUVIUM --- Silt sand and gravel of flood plains and alluvial fans. Thickness, 0 to 50 feet.

UINTA FORMATION

$Tu_5$ Unit 5 --- Brown and buff weathering sandstone with minor siltstone. Thickness, 200 to 500 feet.

$Tu_4$ Unit 4 --- Buff and brown cliff-forming sandstone with minor siltstone and rare lenticular marlstone. Maximum thickness, 350 feet.

GREEN RIVER FORMATION

Tgtu Thirteenmile Creek Tongue, upper part --- Light grey to white-weathering marlstone, with some thin fossiliferous limestone beds. Thickness, 20 to 100 feet.

CONTACT, Dashed where approximate.

FAULT, Dashed where inferred; dotted where concealed. U, upthrown side; D, downthrown side.

AIRPHOTO LINEAMENT

SYNCLINE (defined on top of Mahogany zone)

• CH CORE HOLE (data source for this document)

SHAFT

TRACT BOUNDARIES


REFERENCES:

Duncan, 1976, a, Preliminary geologic map of the Square 3 Ranch Quad., Rio Blanco County, Colorado: U.S. Geologic Survey map MF-754.

Duncan, 1976, b, Preliminary geologic map of the Wolf Ridge Quad., Rio Blanco County, Colorado: U.S. Geol. Survey map MF-753.

Smith and Whitney, 1979, Map of joint sets and air photo lineaments of the Piceance Creek Basin, northwestern Colorado: U.S. Geol. Survey Map MF-1120.

westward north of the syncline's axis. The Dudley Bluffs Graben may extend northwestward across the tract in the subsurface.

This oil shale sequence is not homogeneous in grade from top to bottom, but is comprised of a number of stratigraphic zones of alternating rich and lean shales. Lean zones range from 10 to 20 gal/ton in grade and up to 200 feet in thickness. The richer zones range from 20 to over 30 gal/ton in grade and are from 100 to 225 feet thick.

### Important Oil Shale Zones

Beneath the tract, the Mahogany Zone contains oil shale 150 feet thick that averages 30 gal/ton in beds at least 10 feet thick. This zone increases in thickness westward across the tract from approximately 124 feet near the eastern margin to approximately 154 feet near the western margin. In-place resources in shales at least 10 feet thick averaging 30 gal/ton are about 300,000 bbls/acre.

In the stratigraphic lower part of the Green River Formation (R1 through R6), containing both the leached and saline zones, oil shale averaging 30 gal/ton in beds at least 10 feet thick is approximately 750 feet thick. In-place resources in these shales are 1,500,000 bbls/acre.

Tract C-11 may contain total in place oil shale resources of approximately 1,800,000 bbls/acre (intervals at least 10 feet thick average 30 gal/ton). The total in-place resource in beds at least ten feet thick and averaging 30 gal/ton may be approximately 9,200,000,000 barrels. Based on direct mining technologies tested elsewhere in the basin, approximately 2,590,000,000 equivalent barrels of shale oil might be recovered. Recovery estimate does not include the leached zone, as generally poor ground conditions caused by solution cavities and brecciation would severely limit application of direct mining methods.

### Important Sodium Zones

The stratigraphic lower parts of the Green River Formation may contain significant quantities of sodium resources (R-5 through R-3) in the saline zone. At least 750,000 tons of nahcolite per acre and at least 180,000 tons of dawsonite per acre may be present under Tract C-11.

Total sodium resource beneath Tract C-11 may exceed 3,840,000,000 tons of nahcolite and 922,000,000 tons of dawsonite. Approximately 614,000,000 tons of nahcolite and 155,000,000 tons of dawsonite may be recovered from Tract C-11.

## Mineral Resources of Tract C-18

Tract C-18 overlies an extension of the South Rangely Syncline. The axis trends westward across the tract. The Mahogany Zone dips inward from the margins of the tract at about 75 to 100 feet per mile. Numerous fractures have been maped on the tract, but no evidence of faulting has been observed. The Mahogany Zone is approximately 160 to 180 feet thick on the tract, lies at 5,200 to 5,300 feet above sea level, and averages 25 to 30 gal/ton.

The oil shale interval is not homogeneous in grade from top to bottom, but is comprised of a number of stratigraphic zones of alternating rich and lean shale. Lean zones average from 10 to 20 gal/ton in grade and 30 to 150 feet in thickness. Rich zones average from 20 to over 30 gal/ton in grade and 75 to 225 feet in thickness.

Sodium mineralization, including the minerals nahcolite and dawsonite, occurs in the saline zone interbedded with both lean and rich oil shales.

### Important Oil Shale Zones

In the Mahogany Zone, oil shales yielding 30 gal/ton in intervals thicker than 10 feet are 141 feet thick. In place oil resources are approximately 287,000 bbl/acre.

Oil shales averaging 30 gal/ton in beds greater than 10 feet thick are present in the Parachute Creek Member of the Green River Formation below the Mahogany Zone (R-6 Zone) which is approximately 400 feet thick. This part of the stratigraphic section contains in place resources of approximately 213,000 bbls/acre.

The stratigraphically lowest part of the Green River Formation (Saline Zone) may contain oil shales averaging 30 gal/ton in beds 10 feet or more thick. In place resources in this interval are approximately 1,500,000 bbls/acre.

The tract contains total in place oil shale resources of approximately 2,000,000 bbls/acre. Total resources in beds at least 10 feet thick that average 30 gal/ton with approximately 10,240,000,000 barrels under the entire tract. Based on demonstrated direct mining technologies, up to approximately 2,297,000,000 equivalent barrels of shale oil might be recovered from the tract.

As for C-11, recovery estimates do not include production from the leached zone due to poor ground conditions that would significantly limit application of direct mining methods.

## Important Sodium Zones

The saline zone is divided into the Upper Salt and Lower Salt Zones. The Upper Salt Zone contains dominantly massive halite beds with some nahcolite and ranges from 30 to 100 feet in thickness. The Lower Salt Zone averages 20 feet in thickness. It contains thick nahcolite beds and five to ten foot thick nahcolite oil shale beds. The Love Bed within the L-4 Zone of the Parachute Creek Member contains the richest nahcolite deposits. Dawsonite occurs in bedded deposits throughout the saline zone. Under Tract C-18, the Green River Formation may contain up to 800,000 tons of nahcolite per acre and may contain up to 200,000 tons of dawsonite per acre.

Sodium resources beneath C-18 may be as much as 4,100,000,000 tons of nahcolite and 1,000,000,000 tons of dawsonite. Direct mining might recover as much as 564,000,000 tons of nahcolite and 172,000,000 tons of dawsonite.

## Mining and Processing Technologies

### Direct Mining

Direct underground mining for coal, trona, and other bedded soft-rock deposits allows 50 to 75 percent recovery rates within the interval being mined depending upon ground conditions that dictate pillar strengths and maximum size of stable mine openings. Estimated oil shale recovery by room-and-pillar mining on Tract C-b according to the detailed development plan (submitted by Ashland Oil Company in 1976) is only 30 to 50 percent of the shale in a 75 foot thick interval but only about 20 percent for the entire thickness of potentially mineable shale within and about the Mahogany Zone (see Figure III-7).

Many of the modern oil shale room-and-pillar mine designs are patterned after the design developed by the U.S. Bureau of Mines. From Bureau studies it was concluded that 60 foot rooms with 60 foot square pillars would maximize resource recovery, prevent subsidence, and provide a safe working place. Recoveries using this mine design will approach 70 percent if the full thickness of the ore zone can be mined. For additional information on direct mining processing see Chapter II.

### Mine Assisted In-Situ

In mine assisted in-situ processing, the permeability of the oil shale is increased by mining about 20 to 40 percent of the oil shale from the deposit on multiple mine levels and then blasting the remainder into the mine voids to create rubble filled chambers. The two step process is illustrated in Figure III-8. As the retort is pyrolyzed, oil and gas vapors are collected in a sump at the bottom of the retort and pumped to the surface. Mine assisted in-situ technology has been demonstrated by Occidental Oil Shale, Inc. at their Logan Wash property and at Tract C-a by Rio Blanco Oil Shale Company. Uniform fragmentation is a key and difficult to achieve requirement for efficient retorting. Integrated in-situ technology for recovering shale oil, nahcolite, alumina and soda ash has been proposed by Multi Mineral Corporation for the saline zone in the Piceance Creek Basin (see Chapter II). Its overall oil shale recovery efficiency is similar to that described above plus sequential extraction of nahcolite and alumina. For additional information on mine assisted in-situ see Chapter II.

### True In-Situ

Geokinetics has been investigating in-situ retorting of shallow oil shale in Utah since 1973. True in-situ technology like that of Geokinetics can only be applied to shallow shale deposits with less than 500 feet of overburden and will not be considered for these tracts. However, Equity Oil Company in cooperation with the Department of Energy has been conducting true in-situ solution mining below the Mahogany Zone at depths of 775 to 1,325 feet (in the leached zone). Here superheated steam is forced through a system of boreholes underground. The steam circulates through the natural porosity of the leached zone retorting the oil shale. Shale oil is then pumped to the surface through stratigically located producer wells as an oil-water emulsion for surface separation. Problems of maintaining borehole alignment and loss of product to the formation, currently render this process quite inefficient. For more information on true in-situ see Chapter II.

# TOPOGRAPHY

Tracts C-11 and C-18 are located near the depositional center of Piceance Basin, a 1,600 square mile elevated structural basin. Within the basin lies a dissected plateau with relief diminishing from south to north. Elevation in the south is more than

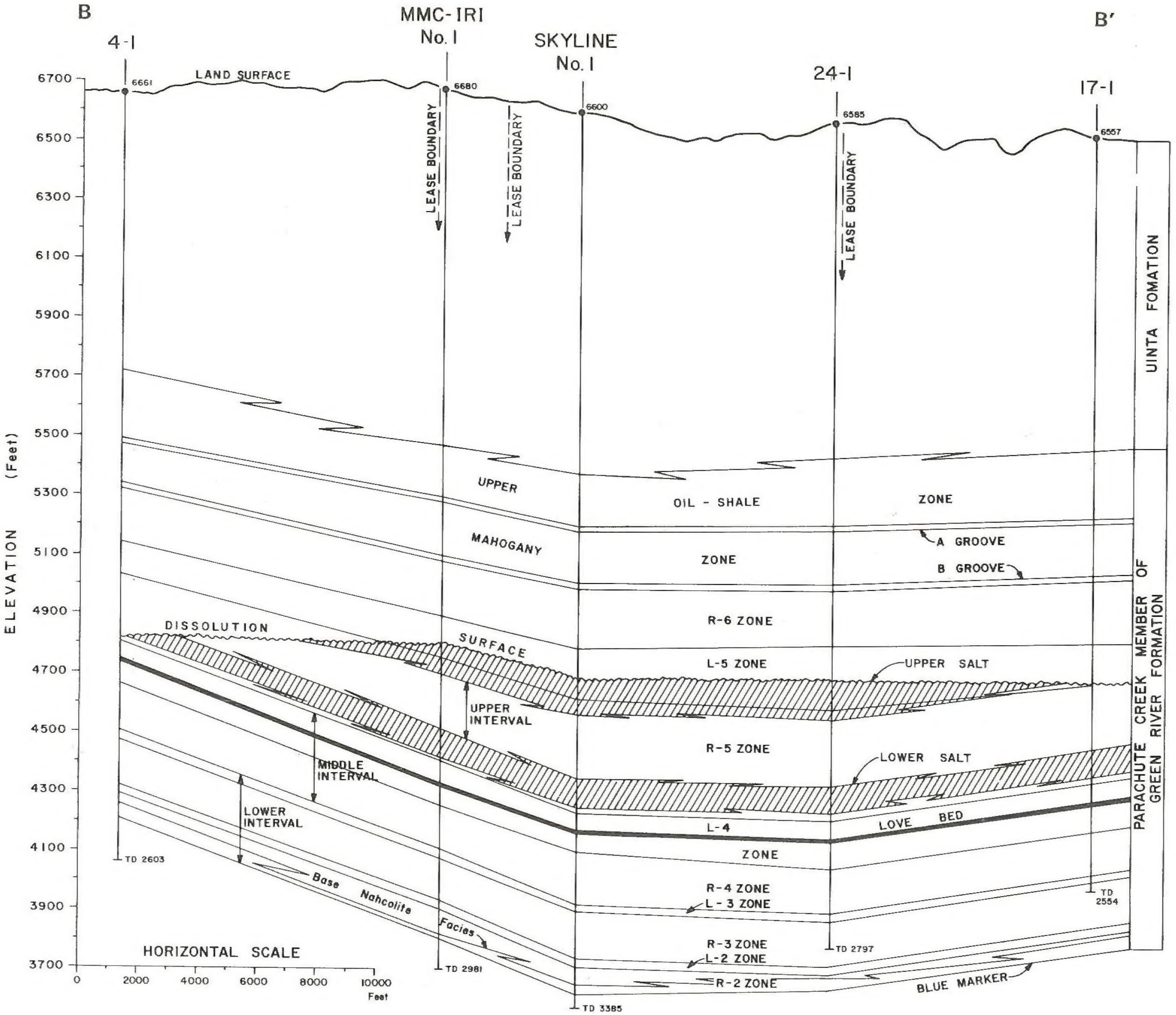
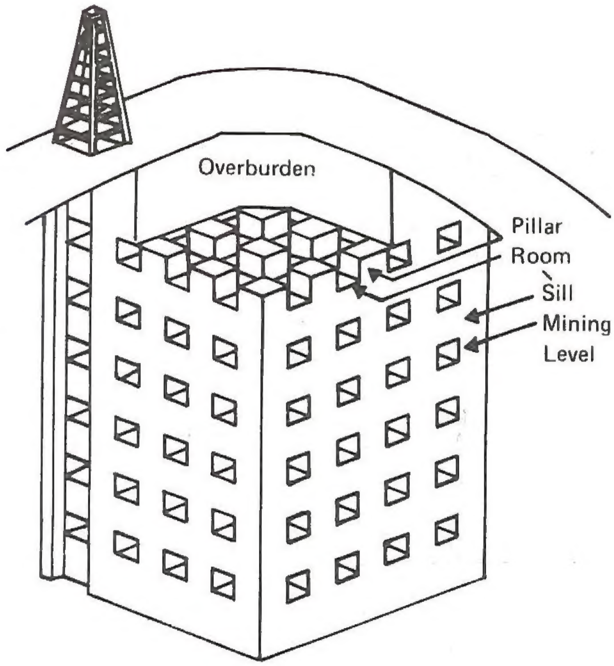
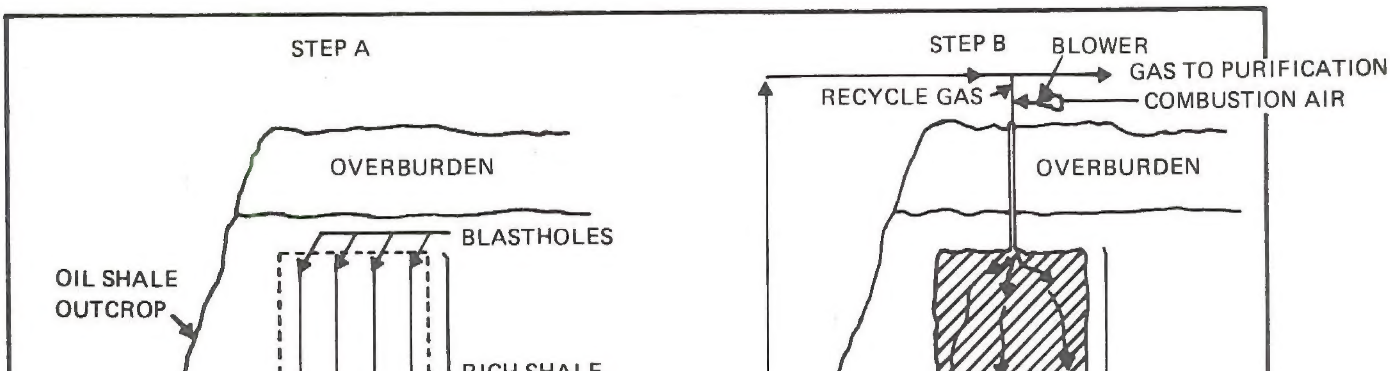



**Figure III-6 Structural Cross Section B-B′ Through the Southeast Quadrant of Tract C-18. For Location See Figure III-5 (Multi Mineral Corporation 1981)**




SOURCE *Hearing on Oil Shale Leasing* Subcommittee on Minerals, Materials, and Fuels of the Senate Committee on Interior and Insular Affairs. 94th Cong. 2d sess. Mar. 17, 1976. p 83

**Figure III-7 Room and Pillar Mining on Multiple Levels (Congressional Office of Technology Assessment 1981)**




SOURCE T. A. Sladek. "Recent Trends in Oil Shale—Part 2. Mining and Oil Shale Extraction Processes." *Mineral Industries Bulletin.* Vol. 18. No. 1 January 1975. p 18

**Figure III-8 Modified In-Situ Retorting (Congressional Office of Technology Assessment 1981)**

9,000 feet and ranges to 5,000 feet above sea level at the northern edge.

Both tracts are located on Bar D Mesa, a dissected plateau with gently rolling slopes of three to seven percent. Elevation of the tracts ranges from 6,100 feet along Yellow and Piceance Creeks to 6,794 feet on top of the mesa. Total relief is approximately 700 feet. Drainages dissecting into the mesa generally range in slope from 14 to 17 percent on northern aspects to 36 to 100 percent on southern aspects. Drainage of the tracts is trellis to parallel, reflecting the influence of bedrock jointing.

Tract C-11 is located on the southern aspect of Bar D Mesa. The southeast and northeast corners of the tract are dissected by Ryan Gulch and Horse Draw, respectively. Those portions of the tract immediately on the south sides of those two drainages provide the only predominant northern exposure on the tract. Being on the south side of Bar D Mesa, C-11 is much more dissected by ephemeral tributary drainages (of Ryan Gulch and Horse Draw) than Tract C-18. Tract C-11 land area is evenly divided between gentle slopes of three to seven percent to steeply sloping hillsides of the tributary drainages of 36 to 100 percent slopes.

Tract C-18 is located on the northern aspect of Bar D Mesa. This tract is dissected by tributaries of Yellow Creek that drain northward. The tract has only a small portion of southern exposure in the far southeast corner of the tract and contains the upper portion of Horse Draw. The majority of Tract C-18 is gently sloping with slopes of two to ten percent.

## FLOODPLAINS

Floodplains within the lease tract areas occur along Ryan Gulch and Yellow Creek. The potential for flooding exists throughout the basin, with the major events resulting from high intensity localized thunderstorms. Runoff from these storms can be quite high as evident by a 6,800 cubic feet per second (cfs) instantaneous discharge measured at Yellow Creek near White River Station on September 7, 1978. The US Army Corps of Engineers (1982) has analyzed portions of the Yellow Creek and Ryan Gulch floodplains. Their floodplain delineations as shown in Figure III-9 are based upon a 100 year floodplain and a minimum watershed of five square miles. The 100 year flood peaks determined by the Corps of Engineers for Yellow Creek is 6,200 cfs, and for Ryan Gulch is 3,300 cfs (Hatch 1982).

The extreme northwest corner of Tract C-18 is located immediately adjacent to and possibly in, the 100 year floodplain of Yellow Creek. Ryan Gulch runs diagonally through the southeastern part of Tract C-11. While the drainage area of Ryan Gulch is quite small, the potential for flooding does exist.

## ALLUVIAL VALLEYS

Alluvial valleys are associated with the major drainages in Piceance Basin. These are topographically low areas which have a thick mantle of unconsolidated sediments (colluvium and alluvium) and receive additional runoff moisture from upland areas. This additional moisture and the generally gentle slopes make some of these alluvial valleys suitable for subirrigated or flood irrigated agricultural production (principally hay meadows).

Most of the irrigated alluvial valleys in Piceance Basin are used for hay production which is of vital importance to the local livestock industry. Hay production makes it possible for livestock operators to feed their herds when no other forage is available during the winter months. Some alluvial valleys, which have not been developed for agricultural use, produce riparian vegetation which is important to wildlife.

On Tract C-11, Ryan Gulch and Horse Draw have alluvial valleys associated along their lengths which occupy about 580 acres (11 percent of the tract). They have not been developed for agriculture and do not have extensive areas of riparian vegetation. On Tract C-18, about 130 acres (2 percent of the tract) of alluvial valley is found associated with drainages which are tributary to Yellow Creek. A very small (5 acre) portion of this could be used for agricultural production. Adjacent to the tracts, alluvial valleys are associated with Yellow Creek and Piceance Creek. Portions of these alluvial valleys have been developed for agriculture.

## AGRICULTURAL LANDS

Agricultural land is all land that produces agricultural commodities. Agricultural land varies greatly in productivity and includes cropland, rangeland and woodland. Cropland is generally the most productive agricultural land which is periodically tilled and planted to a specific economic plant. Generally, cropland is harvested by mechanical means. Cropland in Rio Blanco, Garfield and Mesa Counties may or may not be irrigated. Rangeland is agricul-

tural land that is generally less productive than cropland. Rangeland is rarely tilled and most production is from native perennial plants. Generally, rangeland is harvested by livestock. In this area, rangeland is important wildlife habitat as well. For the purposes of this discussion, woodland is included as a portion of rangeland because forage for grazing animals is an economically and biologically important product of woodlands.

In this area, livestock production is the primary agricultural activity. Most cropland is used to produce winter feed for livestock, while rangelands are used during the spring, summer and fall. Therefore, the dominant agricultural activity depends upon the availability of both cropland and rangeland (see Chapter III, Vegetation-Grazing).

Based on acreage planted in 1979 and conversations with local Soil Conservation Service officials, the following amounts of cropland are estimated to be available in the area:

Rio Blanco County -- 68,500 acres

Garfield County -- 98,600 acres

Mesa County -- 84,500 acres

No croplands, prime farmlands or unique farmlands are present within the tract boundaries (SCS 1982). The only agricultural use of the tracts is grazing of rangelands. However, irrigated pasture land and hayland of statewide importance occurs in adjacent off-tract locations within the drainages of Piceance, Black Sulphur and Yellow Creeks, and the White River. Prime farmlands are also located in scattered segments along Piceance Creek from Hunter Creek to Dry Fork, and along the White River from Meeker west through Powell Park. No unique farmlands are present within Rio Blanco County.

Agricultural lands of particular importance in Mesa County are the 10,000 acres of orchard lands considered prime farmland by the Soil Conservation Service.

# SOILS

## Introduction

The soils within the tracts were mapped to Order III by the Soil Conservation Service (SCS 1982). The location of Soil Mapping Units is shown on Figure III-10.

This Order III soil survey was mapped on a base of 1:24,000. The minimum sized cartographic unit at this scale is about six acres in size. Mapping units are not taxonomically pure; soils other than the named soil will occur within the map unit. These other soils are called inclusions and are generally not of large extent. This soil survey was designed to provide rangeland interpretations and a base for land use planning. It is adequate for these uses, however development of a detailed mine plan would require a more detailed soil survey designed to provide specific interpretations for engineering and reclamation.

These soils are generally cold (mean annual soil temperature of less than 8°Centigrade) and are dry a large portion of the time that soil temperatures are warm enough for plant growth.

## Soil Descriptions

The following is a technical description of some characteristics of the soil map units shown in Figure III-10 by their topographic location.

### Sideslope Soils

Two map units have been identified on sideslope positions. Unit 63 is Rentsac channery sandy loam, 5 to 50 percent slopes. (Channery indicates the soil surface has between 15 and 35 percent by volume of gravel or cobble sized rock fragments (channers) that are much smaller in one dimension than in the other two dimensions. A channer is a small flagstone.) Unit RT is a Torriorthents-Rock Outcrop Complex which is excessively drained, gravelly cobble on 15 to 90 percent slopes.

Rentsac soils are less than 20 inches deep to hard bedrock and are dominantly very channery sandy loam in texture. Torriorthents-Rock Outcrop complex is an intricately intermixed grouping of weakly developed soils (about 60 percent of the unit) and rock outcrop (about 40 percent of the unit).

### Bottomland Soils

Three map units have been identified in bottomland positions. Unit 75 is Barcus channery loamy sand, 2 to 8 percent slopes. Unit 41 is Glendive fine sandy loam, 2 to 15 percent slopes. Unit 38 is Havre loam, 0 to 3 percent slopes. These soils are all receiving sediment more rapidly than they are forming diagnostic horizons. All of these soils are at least 60 inches thick.

Barcus soils are dominantly channery sand or channery loamy sand in texture and somewhat excessively well drained. Glendive soils are dominant-

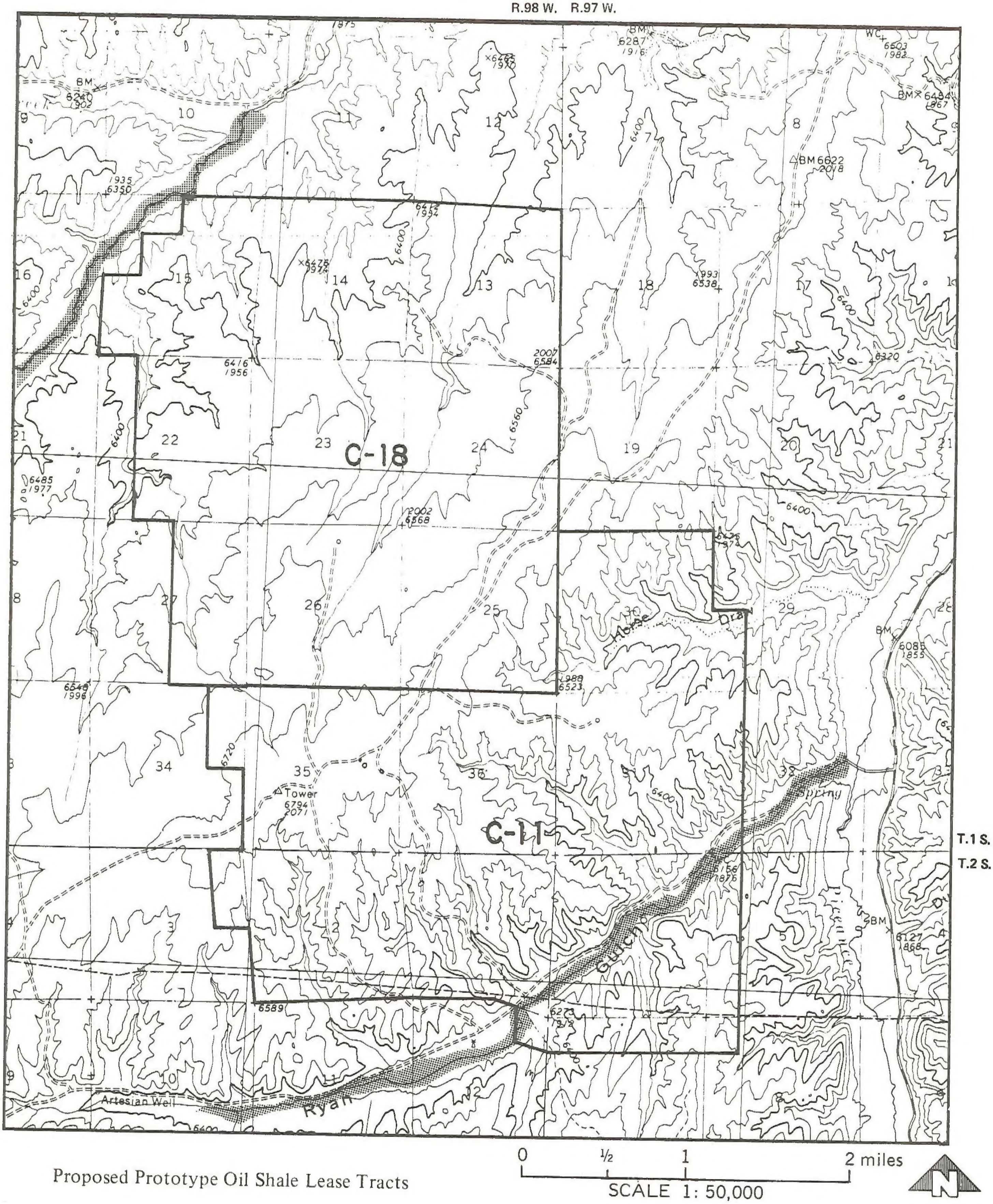
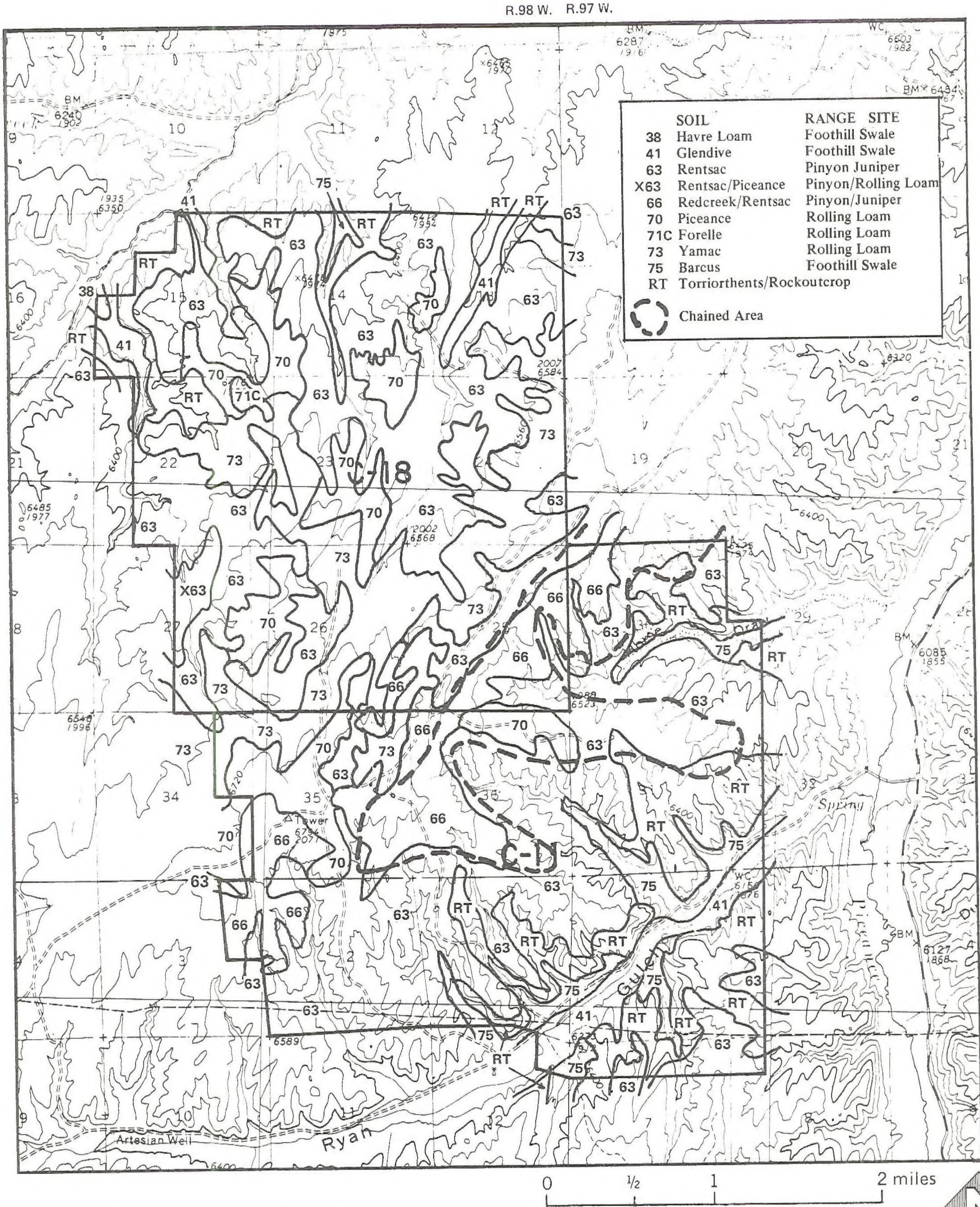



**Figure III-9 Extent of Floodplains of Ryan Gulch and Yellow Creek, Based Upon 100 Year Floodplain Limits**




Proposed Prototype Oil Shale Lease Tracts

**Figure III-10 Soil and Range Sites of Tracts C-11 and C-18**

ly fine sandy loam in texture and well drained. Havre soils are dominantly loam and silty clay loam in texture. Havre soils are strongly alkaline below a depth of about 25 inches.

#### Upland Soils

Five map units have been identified on upland positions. Unit 71C is Forelle loam, 3 to 8 percent slopes. Unit 70 is Piceance fine sandy loam, 5 to 15 percent slopes. Unit 66 is the Redcreek-Rentsac complex, 5 to 30 percent slopes. Unit X63 is the Rentsac-Piceance complex, 2 to 30 percent slopes. Unit 73 is Yamac loam, 2 to 15 percent slopes.

Forelle soils and Yamac soils are dominantly loam and clay loam in texture, are well drained, and are about 60 inches thick. Piceance soils are dominantly sandy loam and loam in texture, are well drained, and are 20 to 40 inches thick over hard bedrock. The Redcreek-Rentsac complex is an intricately intermixed grouping of Redcreek soils (about 60 percent of the unit) and Rentsac soils (about 30 percent of the unit). Redcreek soils are dominantly sandy loam in texture, are well drained, and less than 20 inches thick over hard bedrock. Rentsac soils are similar to those Rentsac soils which have been previously described. The Rentsac-Piceance complex is an intricately intermixed grouping of Rentsac soils (about 60 percent of the unit) and Piceance Soils (about 30 percent of the unit). These soils are similar to the Rentsac soils and Piceance soils which have been previously described.

### Soil Moisture

In the semiarid environment, water limits plant growth. In this environment, the ability of a soil to hold moisture is at least as important as nutrient availability. Finer textured soils (loams and clay loams) are more effective at holding moisture than coarser textured soils (sandy loams, channery sandy loams, and very channery sandy loams). Soils on steep slopes will generate more runoff than gently sloping soils. This runoff is not available to plants on the site from which it runs off, however bottomland soils receive additional moisture from runoff. Because of these soil moisture relationships, the bottomland soils are more productive than are the sideslope or upland soils as the bottomland soils have more moisture than is available from precipitation. The upland soils are more productive than the sideslopes because they generate less runoff than the sideslope soils. Also these upland soils are generally of a finer texture and are more effective at holding moisture than are the sideslope soils.

### Soil Erosion

Soil erosion is controlled by many factors including climate, plant cover, length and steepness of slope, inherent erodibility of the soil and land use. Of these factors, land use and plant cover are most directly under human control. By reducing plant cover or changing land use, management can accelerate erosion above natural rates. This can cause reduction in productivity of the eroded site and downstream sedimentation problems. The weighted average erosion rate for Tract C-11 is 3.4 tons per acre per year and for Tract C-18 is 2.8 tons per acre per year using the Universal Soil Loss Equation (USDA 1978). This is an estimate of sheet and rill erosion. These soil loss estimates cannot be directly converted to sediment yields because they do not include gully or channel erosion nor do they account for deposition of material prior to its entrance to perennial water courses (see Chapter III, Hydrology). Table III-8 shows acreage and estimated erosion rates by soil map unit for the oil shale lease tracts.

## HYDROLOGY

Very little site-specific water resource data has been collected on Tracts C-11 and C-18. In contrast, there has been a considerable amount of water resource data collected in the basin, with a majority being collected around the existing prototype least tracts.

The following is a brief description of the water resources of the Piceance Basin as a whole, with site specific data presented where available. Unless noted otherwise, most of the following data describing the groundwater resources of the Basin were obtained from Weeks et al (1974).

### Groundwater Quantity

Groundwater occurs throughout Piceance Basin. The principal water bearing strata within the basin are the Uinta and Green River Formation (see Figure III-11) with the Green River Formation being the most important. The groundwater system within the Piceance Basin is highly fractured and extremely complex. For description purposes, the aquifer

system can be considered to be divided into an upper and lower aquifer. These two systems are separated by a less permeable oil shale rich zone known as the Mahogany Zone. Estimates of groundwater storage of the basin range up to 25 million acre feet, (International Engineering Company Inc. 1981).

Wells within the upper aquifer yield as much as 300 gal/min, but yields of less than 100 gal/min are more common. Transmissivities in the Piceance Basin range from 8 to 1,000 ft²/day, and average 668 ft²/day on Tract C-18 (Multi Minerals Corporation 1982). The average depth to water in the upper aquifer at both C-11 and C-18 is approximately 300 ft.

The upper and lower aquifers are separated by a relatively impermeable stratum known as the Mahogany Zone. The Mahogany Zone is locally fractured, and permits same degree of vertical exchange of water between the aquifers. The vertical hydraulic conductivity has not been adequately determined, but estimates place it as large as 0.37 feet per day (Weeks et al 1974). However, the Mahogany Zone in Tracts C-11 and C-18 is located in a transition zone between recharge and discharge areas of the upper and lower aquifers with near equal hydraulic head pressure.

Wells developed within the lower aquifer yield as much as 1,000 gal/min, but 200 to 400 gal/min is more typical. Based on limited testing, the transmissivities of the lower aquifer within the proposed lease tracts are less than those of the upper aquifer and averages 320 ft²/day (Multi Minerals Corporation 1982). This is not generally the case throughout the basin. Basin wide, the transmissivities of the lower aquifer range from 8 to 1,670 ft²/day and are usually greater than the upper aquifer.

Alluvial aquifers are also present within the basin. The areal extent of these aquifers is limited to the valley bottoms along the major creeks. The total available water in the alluvial system is small compared to the other aquifers, however, the alluvial system acts as the interface between streamflow, runoff, and groundwater discharge.

Recharge to the aquifer system occurs primarily from snowmelt in the upper elevations. In the area of recharge, part of the water moves from the upper aquifer through the Mahogany Zone to the lower aquifer (Weeks et al 1974). Groundwater flow is generally from the recharge areas at the basin margins to the discharge areas in the north central portion.

Groundwater outflow from the system basin-wide is upward from the lower aquifer through the Mahogany Zone to the upper aquifer. Water is then discharged to the streams from the upper aquifer through the alluvium or springs. Groundwater is lost from the basin by evapotranspiration or discharge from Piceance and Yellow Creeks. According to Weeks et al (1974), no significant amount of groundwater discharges to the White River directly from the Green River Formation, except through Piceance and Yellow Creeks.

Current use of groundwater within the basin is minimal. Groundwater discharge accounts for over half the base flow in the major basin drainages and is indirectly the primary source of water for hay meadow irrigation and animal use along the major drainages. Other groundwater uses are for domestic and livestock watering wells. There are numerous springs and seeps which supply water for livestock and wildlife. Because of the large number of springs in the basin, the reader is referred to a report prepared for the U.S. Geological Survey by the Colorado State Engineer (1978) entitled *Piceance Basin Spring Hydraulics Investigation*.

## Groundwater Quality

The groundwater quality of Piceance Basin varies between aquifers, and also by location. In general, water in the upper aquifer is of better quality than the lower aquifer. In addition the groundwater in the recharge areas is of better quality than the discharge areas.

The water in the upper aquifer may be classified as a sodium bicarbonate type. Dissolved solid concentrations for the upper aquifer vary from 400 milligrams per liter (mg/l) to 2,000 mg/l. Calcium, magnesium and sulfate concentrations in the upper aquifer are greater than the lower. Water quality samples obtained from the upper aquifer in the vicinity of the proposed lease tracts have total dissolved solid concentrations which vary from 612 to 1020 mg/l (Multi Minerals Corporation 1982).

The total dissolved solids of the lower aquifer vary from 500 mg/l to nearly 40,000 mg/l. Dissolved solids concentrations of 63,000 mg/l have been reported from a sample obtained from the high resistivity zone. Samples obtained by the USGS from the lower aquifer on Tract C-18 have dissolved solid concentrations which vary from 650 to 9,610 mg/l, with all but this high value being in the 1,000 mg/l range. The maximum TDS concentrations obtained from the lower aquifer after seven days of pumping was 1,040 mg/l (Multi Minerals Corporation 1982). These results indicate that there is not a great difference in salinity between the upper and lower aquifer in the area of the lease tracts. The lower aquifer water can be classified as a sodium bicarbonate type.

TABLE III-8
SOIL MAP UNIT ACREAGE AND EROSION RATES

| | Tract C-11 | | Tract C-18 | |
|---|---|---|---|---|
| Soil Map Unit | Acres 1/ | Soil Loss 2/ Tons/Acre/Year | Acres 1/ | Soil Loss 2/ Tons/Acre/Year |
| 75 - Barcus | 350 | 0.15 | 20 | 0.15 |
| 71C - Forelle | -- | -- | 20 | 0.09 |
| 41 - Glendive | 230 | 0.08 | 100 | 0.08 |
| 38 - Havre | -- | -- | 10 | 0.01 |
| 70 - Piceance | 300 | 0.4 | 550 | 0.4 |
| 66 - Redcreek/Rentsac | 650 | 2.1 | 230 | 2.1 |
| 63 - Rentsac | 2,420 | 4.6 | 2,470 | 4.6 |
| X63 - Rentsac/ Piceance | -- | -- | 70 | 2.0 |
| RT - Torriorthents/ Rock Outcrop | 1,020 | 4.7 | 350 | 4.7 |
| 73 Yamac | 150 | 0.4 | 1,300 | 0.4 |

1/ Acreage numbers have been rounded to the nearest ten acres.

2/ Estimates generated by the Universal Soil Loss Equation (USDA 1978).

TABLE III-9
CHARACTERISTICS OF MAJOR STREAMS

| Characteristics | White River Near Ouray, UT | Piceance Creek at White River | Yellow Creek Near White River |
|---|---|---|---|
| Drainage Area (Square miles) | 5,120 | 652 | 262 |
| Average Annual discharge (cfs) 1/ | 241,880 | 10,518 | 660 |
| Maximum Daily Discharge (cfs) 1/ | 4,200 | 186 | 500 |
| Minimum Daily Discharge (cfs) 1/ | 110 | 0.70 | 0 |
| Average Daily discharge (cfs) 1/ | 662 | 28.8 | 1.81 |
| Maximum Instantaneous discharge (cfs) 1/ | 4,260 | 628 | 6,800 |
| 1980 Sediment Discharge (tons) 2/ | 2,046,110 | 56,115 | 12,495 |
| Maximum Daily Sediment Discharge (tons/day) 1/ | 268,000 | 2,900 | 290,000 |
| Minimum Daily Sediment discharge (tons/day) 1/ | 0.69 | 0.10 | 0 |
| Maximum TDS (milligrams per liter) 1980 2/ | 702 | 1,710 | 2,090 |
| Minimum TDS (milligrams per liter) 1980 2/ | 261 | 731 | 489 |

1/ For the period 1975-1980.

2/ 1980 water year.

Source: USGS Water Resource Data

Conversion: cfs x 1.9835 = acre feet.

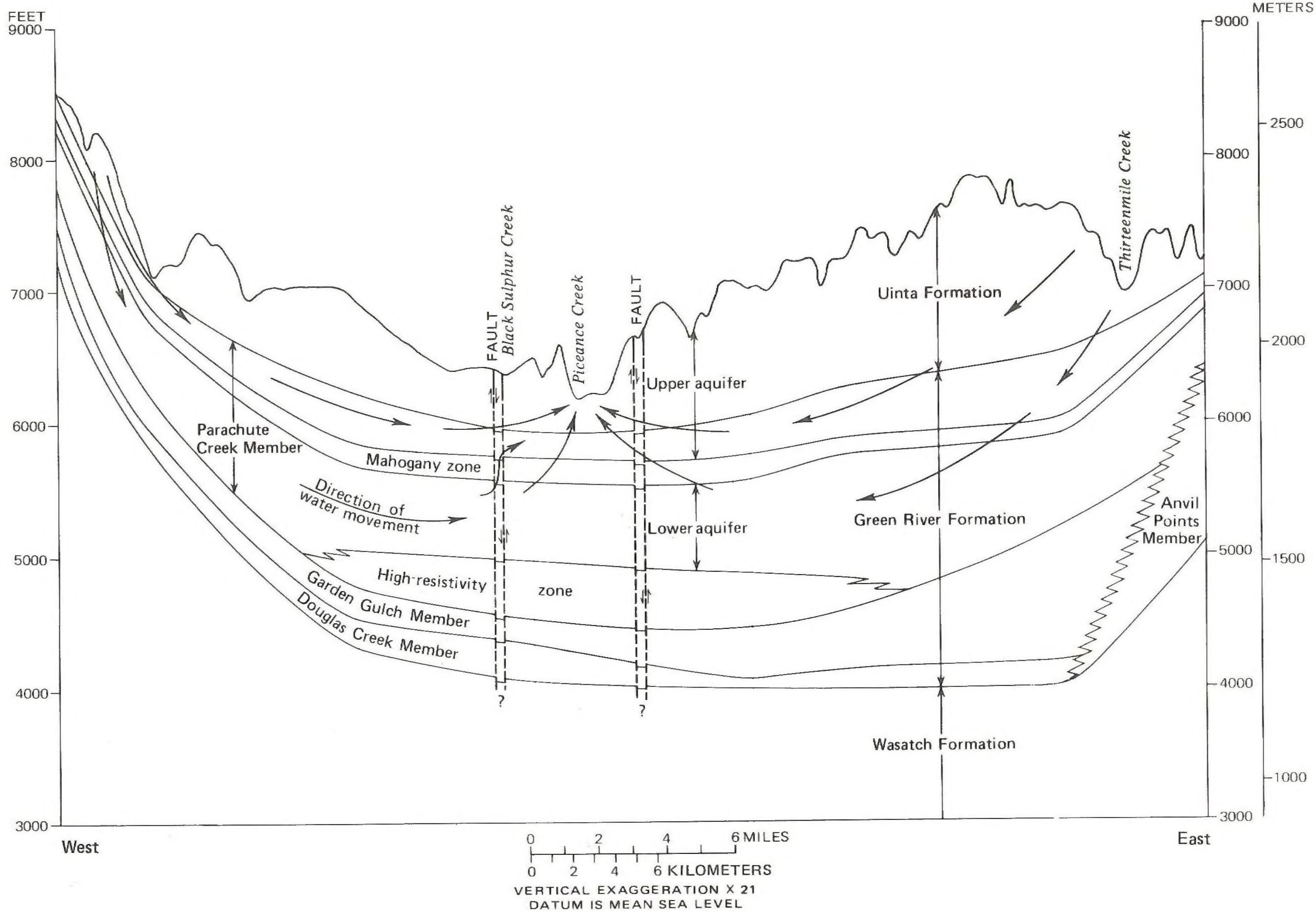



**Figure III-11 Geohydrologic Section Through the Piceance Basin Showing Relation of the Aquifers to the Green River and Uinta Formations (Weeks et al 1974)**

Throughout the basin, the lower aquifer has a much higher concentration of fluoride than the upper aquifer. The fluoride concentrations in the lower aquifer are worth noting. The average fluoride concentration for 27 wells sampled in the Basin is 28 mg/l. It is rare to have fluoride concentrations greater than 10 mg/l. Wells sampled in the lower aquifer on Tracts C-a and C-b for the period 1974 to 1976 had average fluoride concentrations of 14.69 and 21.0 mg/l respectively. The range for these averages were 0.3-85 mg/l for C-a and 4-48 mg/l for C-b (Fox 1980). Fluoride concentrations obtained from well TH75-6B located on Tract C-18 range from 12-26 mg/l (Multi Minerals Corporation 1982).

The concentration of some trace elements within the lower aquifer are great enough to be of environmental concern. Concentrations of barium, boron and lithium are consistently high in the northern part of the basin, indicating that minerals of these elements may be associated with the nahcolite and halite. Concentrations of barium exceed drinking water standards in 7 out of 11 wells sampled by Weeks et al (1974). Samples taken from well TH75-6B have dissolved boron and barium concentrations of 2,900 and 300 micrograms per liter respectively. Boron concentrations in excess of 3,000 micrograms/liter are toxic to most plants. A maximum of 1,000 micrograms/liter of barium is recommended for drinking water (Weeks et al 1974).

## Surface Water Quantity

The White River which drains the study area is tributary to the Green River, a tributary to the Colorado River. Piceance and Yellow Creeks, the two major drainages of the Piceance hydrologic basin, are tributaries to the White River. The proposed lease Tracts C-11 and C-18 are located between Piceance and Yellow Creeks, and drain into them.

The primary source of streamflow to both Piceance and Yellow Creeks is groundwater discharge. Recharge of the groundwater system is principally from snowmelt. Precipitation accumulates during the months of November through March at higher elevations (greater than 7,000 ft.) and produces a period of high recharge and high streamflow beginning in March to April and continues through June or July. Annual precipitation in the lease tract area is approximately 13 in/year. Streamflow for the remainder of the year is maintained almost totally by groundwater discharge, with approximately 80 percent of streamflow in the basin being supplied by groundwater (Weeks et al 1974). Because evapotranspiration rates are extremely high during the summer months, only high intensity thunderstorms produce any significant contributions to summer streamflows.

Table III-9 is a tabulation of the major streamflow characteristics of the area. The White River near Ouray, Utah streamflow station is close to the confluence of the White and Green Rivers. The drainage area of this station is approximately 5,120 square miles. The average annual discharge for the 1975 to 1980 water year is 241,880 cubic feet per second (cfs) (480,000 acre-feet). Average daily discharge for the period of record is 662 cfs with a daily minimum and maximum of 110 and 4,200 cfs respectively. In addition, a long-term (1923-1977) gage record on the White River near Watson, Utah shows that the average annual flow is 693 cfs (502,100 acre-feet) with extremes of flow ranging from 11 cubic feet per second (December 1972) to 8,160 cubic feet per second (July 1929). The average flow of the White River above Rangely was 475,300 acre-feet for the period 1972-1980.

The drainage area of Piceance Creek is 652 sq. mi. which is 13 percent of the White River basin. Average annual flow of the Piceance Creek at the White River steamflow station is 10,518 cfs (20,862 acre feet), (6 year record) or about 4 percent of the average annual flow of the White River. Minimum and maximum daily discharges for the period 1975-1980 are 0.70 and 186 cfs respectively. Maximum instantaneous peak flow for Piceance Creek was 628 cfs.

Yellow Creek is the smaller of the two streams within the Piceance hydrologic basin. The drainage area measured at the Yellow Creek near White River streamflow station is 262 sq. mi. Average annual discharge is 660 cfs (1,309 acre feet) with a maximum daily flow of 500 cfs. A flood peak of 6,800 cfs occurred during 1978. As can be seen from Table III-9, Yellow Creek has experienced a few short periods of no flow.

## Surface Water Quality

The surface water quality of both Piceance and Yellow Creeks can be classified as a mixed bicarbonate type in the upper reaches, and a sodium bicarbonate in the lower reaches. The concentration of dissolved solids, fluoride and sodium increase in the downstream direction. Irrigation return flows, evapotranspiration, and groundwater discharge from both the Uinta and Green River formations are the main cause of the water quality degradation in Piceance Creek. Increases in the water quality constituents for Yellow Creek are attributed primarily to groundwater inflows.

Total dissolved solid (TDS) concentrations for both Piceance and Yellow Creeks vary substantially with streamflows. When streamflows are high, (snowmelt periods) TDS concentrations are the lowest. The increases in TDS during low flow conditions are good indications of the discharging of groundwater to the streamflows of both Piceance and Yellow Creeks. Table III-9 displays the maximum and minimum TDS in mg/l for Piceance and Yellow Creeks for the water year 1980, for the days sampled. Yellow Creek has a TDS range of 489 to 2,090 mg/l, while Piceance Creek varies from 731 to 1,710 mg/l. The total dissolved solids of the White River are much lower than the water it receives from both Piceance and Yellow Creeks due to a dilution effect caused by better quality upstream water on the main stem. Total dissolved solids measured at the White River near Ouray station vary from a minimum of 261 mg/l to a maximum of 702 mg/l.

Sediment yields from Piceance and Yellow Creeks are quite high. The annual sediment yield of Piceance Creek for water year 1980 were 56,115 tons (86 tons/square mile), (Table III-9). Extremes for the period 1976-80 vary from a daily minimum of 0.10 tons to a daily maximum of 2,900 tons. Daily extremes for Yellow Creek for the same period of record vary from 0 to 290,000 tons. This was an extreme event which occurred on September 7, 1978, and corresponds with the maximum discharge for Yellow Creek. The event was a result of a high intensity localized thunderstorm which occurred in the lower portion of the basin (Kircher 1982). Annual sediment yields for Yellow Creek for the water year 1980 were 12,495 tons (48 tons/square mile). Sediment yields for the White River as measured near the Ouray, Utah station are 2,046,110 tons/year (400 tons/square mile) for water year 1980. Sediment yields for the White River range from 0.69 to 268,000 tons/day for the 1975-80 period.

## VEGETATION

### Types

The major vegetation types in the White River Resource Area are pinyon-juniper (33 percent), sagebrush (31 percent), mountain shrub (15 percent), waste land (8 percent), grassland (3 percent), greasewood (3 percent), and saltbrush (4 percent). These vegetation types occur on approximately 1.5 million acres of land. In discussing the oil shale lease tracts these vegetation types will be described in terms of range sites developed by the Soil Conservation Service (SCS 1978).

The area being considered for oil shale leasing consists of foothill swale range sites; rolling loam range sites; rocky and mountain pinyon-juniper woodland sites; and a broadly defined group of soils, which support sparse pinyon-juniper and sagebrush overstory. No riparian vegetation or wetland habitats are known to exist within the tract boundaries.

Most of the foothills swale site exists in Ryan Gulch. The side slopes between Ryan Gulch and the top of the mesa consist of rocky pinyon-juniper woodland sites, and sparse overstories of pinyon-juniper and sagebrush on broadly defined soils. The top of the mesa consists of rolling loam range sites and rocky and mountain pinyon-juniper woodland sites (Figure III-10).

Range sites in Tract C-11 occur in the following percentages:

- Foothills swale -- 10
- Rolling loam -- 20
- Rocky Pinyon-Juniper -- 35 (300 acres chained)
- Broadly defined group -- 10
- Mountain Pinyon-Juniper -- 25 (400 acres chained)

Range sites in the C-18 Tract occur in the following percentages:

- Foothills swale -- 2
- Rolling Loam -- 33
- Rocky Pinyon-Juniper -- 35
- Broadly defined group -- 5
- Mountain Pinyon-Juniper -- 25 (500 acres chained)

These range sites are discussed below based on the present plant community species and production.

#### Foothills Swale

This range site is a shrub community with a fair understory of grasses and forbs. The principal plant species consist of western wheatgrass, needle-and-thread, bluegrass, and a variety of annual forbs with a moderately dense overstory of big sagebrush and greasewood. Composition by weight of annual production for grasses, forbs and shrubs is approximately 49, 11 and 40 percent, respectively. Estimated ground cover is 25 to 30 percent. This site is

presently producing approximately 700 lbs/acre of herbage annually.

### Rolling Loam

This range site is a moderately dense stand of shrubs with a sparse understory of forbs and grasses. The principal plant species are western wheatgrass, needle-and-thread, bluegrass, and a variety of forbs, with an overstory of big sagebrush, greasewood and scattered juniper stands. Estimated ground cover is 20 to 25 percent. This site is presently producing 350 lbs/acre of herbage annually.

### Mountain Pinyon-Juniper

This range site is a pinyon-juniper woodland situation with sparse grass, forb and shrub production. The principal plant species are Sandberg bluegrass, slender wheatgrass, western wheatgrass, big sagebrush and bitterbrush. The overstory is again dominated by juniper with scattered pinyon. Vegetation ground cover is between 10 and 15 percent. Tree canopy cover can range from 70 to 80 percent. The average annual herbaceous production is 300 lbs/acre.

Approximately 900 acres of this range site has been chained. The present plant community in the chained area is western wheatgrass, needlegrass, Indian ricegrass and crested wheatgrass with an overstory of big sagebrush, bitterbrush, rabbitbrush, small pinyon and small juniper. This site is presently producing approximately 650 lbs/acre of herbage annually.

### Rocky Pinyon-Juniper

This range site is a woodland-shrub-grass complex on moderately steep to very steep hillsides with frequent sandstone and shale outcrops. The principal plant species are needle-and-thread, bluegrass, western wheatgrass, big sagebrush, bitterbrush, mountain mahogany and rabbitbrush. The overstory is pinyon and juniper. Vegetative ground cover is about 10 percent. Tree canopy cover is about 40 percent. The average annual production is 200 lbs/acre.

Approximately 300 acres of this site was also chained and has similar composition and production rates as the previously described chained mountain pinyon-juniper site.

### Broadly Defined Soils

There is no single native plant community that can be identified for the vegetation on the broadly defined soils. The present vegetation consists of slender wheatgrass and Indian ricegrass with an overstory of fringed sagebrush, big sagebrush, greasewood, rabbitbrush and scattered pinyon-juniper. This area produces approximately 250 lbs/acre of herbage annually.

## Threatened and Endangered Plants

A field survey of both Tract C-18 and C-11, for the occurrence of threatened, endangered or rare plants was conducted in May, 1982 by the Nature Conservancy under contract to the Bureau of Land Management. As a result of this inventory, three locations of *Astragalus lutosus*, dragon milkvetch, were discovered. One location totaling 10 acres was discovered on Tract C-11 while two locations totaling 20 acres were found on Tract C-18. *Astragalus lutosus* is a "candidate" species, Category 2 at the time of this writing. A Category 2 species is defined by the U.S. Fish and Wildlife Service as a "taxa for which information now in the possession of the Service indicates the probable appropriateness of listing, as endangered or threatened, but for which sufficient data is not presently available to biologically support a proposed rule." Specific locality data for the three populations of *Astragalus lutosus* are available upon request at the Bureau of Land Management in Meeker or the BLM District Office in Craig.

The habitat for *Astragalus lutosus* is that of a loose shale scree on steep to rolling slopes of the Green River Formation. Although *Astragalus lutosus* is rather common to the shale outcrops within the Piceance Basin of Colorado, in terms of national significance, it remains quite rare. No other threatened, endangered or rare plants are known to exist on the two tracts.

## Grazing

There are approximately 150,000 AUMs on 139 grazing allotments within the White River Resource Area. The C-11 and C-18 Tracts lie mainly within the F and B pastures of the Square S Allotment, respectively. At the present time, the allotment supports 1,000 cow/calf units from May 15 to December 15. This allotment is currently managed on a six-pasture deferred rotation system.

Grazing capacity for public land on the allotment is 4,390 AUMs. Five hundred AUMs are available on each tract. The potential AUM production on the entire allotment is 6,600. The two tracts combined have the potential of producing 1,400 AUMs; 750 AUMs on Tract C-11 and 650 AUMs on Tract C-18. The potential for increasing AUMs on the C-11 and C-18 Tracts exists through manipulation of sagebrush overstory on the rolling loam range site. In order to achieve production potential, this allotment has been identified in the White River Management Framework Plan for revision of the grazing system and pinyon-juniper and sagebrush vegetation manipulations were recommended to increase grass production. Some of the sagebrush manipulations lie within the tract boundaries.

The existing rangeland projects in the B and F pastures that may be affected include one spring, one well with eight miles of water pipeline, and 1,500 acres of pinyon-juniper chaining. Not all of these projects are actually within the tract boundaries, but are located in areas where development could adversely impact these projects anyway (Figure III-12). On Tract C-11, one well with three miles of water pipeline and 700 acres of pinyon-juniper chaining exist. On Tract C-18, three miles of pipeline and 500 acres of pinyon-juniper chaining are present.

## Forestry

Approximately 46 percent, or 2,300 acres, of Tract C-11 and approximately 50 percent, or 2,500 acres, of Tract C-18 is in pinyon-juniper woodland. Pinyon-juniper is the only forest type found on either tract.

The term woodland refers to an open forest of low, round-crowned trees, often bushy or contorted. The dominant species of the pinyon-juniper woodland in the Piceance Basin include Colorado Pinyon (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*). Tree densities and species composition vary considerably throughout both tracts.

Of all woodland acres on both tracts, only a small portion is considered commercially available, in terms of forest management. No large scale commercial activities or immediate plans for future sales are scheduled on these tracts. However, these tracts are open and managed for occasional individual use of firewood and fencepost cutting.

# WILDLIFE

A total of 28 mammal, 66 bird, 5 reptile, and 1 amphibian species have been recorded or are speculated to inhabit the tracts either as residents or on a migratory basis. Since it is not feasible to address each species separately, only those species that may be significantly impacted or are of major concern will be discussed in detail below.

## Terrestrial

### Big Game

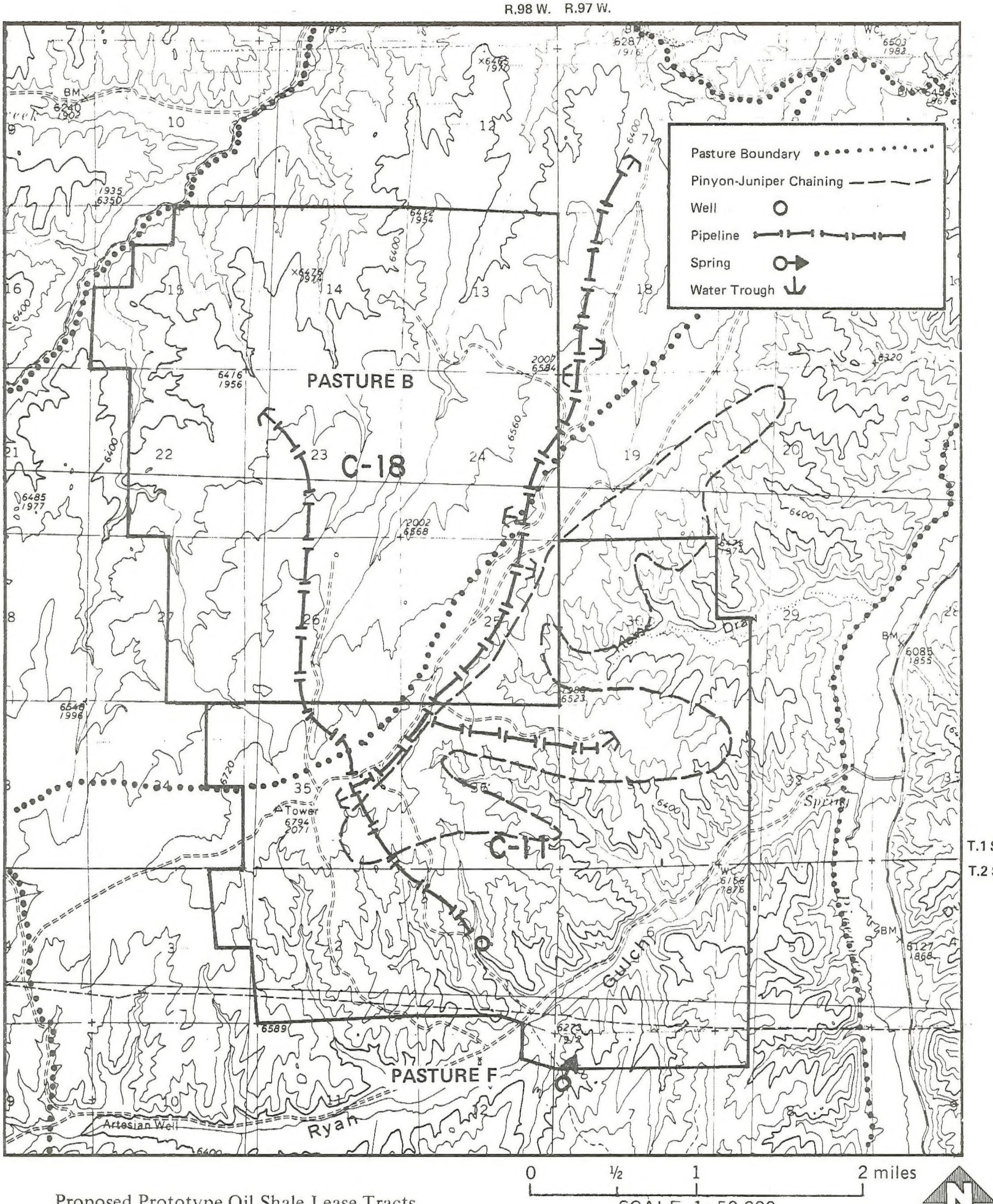
The Piceance Basin mule deer herd is considered to be the largest migratory herd in North America. Populations have fluctuated significantly since the 1950's (15,500 to 70,000) due mainly to severe winters, condition of winter range and habitat destruction. The herd population is presently increasing following a massive die-off during the winter of 1978 to 1979. Browse condition on winter range is generally poor, but has improved slightly over the last four years due to lowered deer populations and a corresponding reduction in winter forage use.

Both tracts are located in mule deer winter range. Ninety-three percent of C-11 and seven percent of C-18 are considered critical winter range by the Colorado Division of Wildlife (DOW). Critical range is key to herd sustenance during winters of unusually heavy and prolonged snow conditions when adjacent winter ranges are unavailable or inaccessible. A seasonal migration route traverses each tract. Figure III-13 indicates the location of ranges and migration routes.

Deer use of the tracts is almost exclusively during late fall, winter and early spring. Large numbers of deer arrive in October and increase in abundance through December as snow accumulations at higher elevations force deer descent to these lower winter ranges. Deer remain abundant on the area until early April and are essentially gone by May.

During winter months, deer seek chained pinyon-juniper and pinyon-juniper woodlands where preferred browse forage is most available. Beginning in March, deer make increasingly heavy use of succulent herbaceous growth in hay meadows and sagebrush bottomlands.

Deer abundance on the tracts varies annually depending on total herd size and winter intensity. During mild winters, deer prefer the use of off-tract

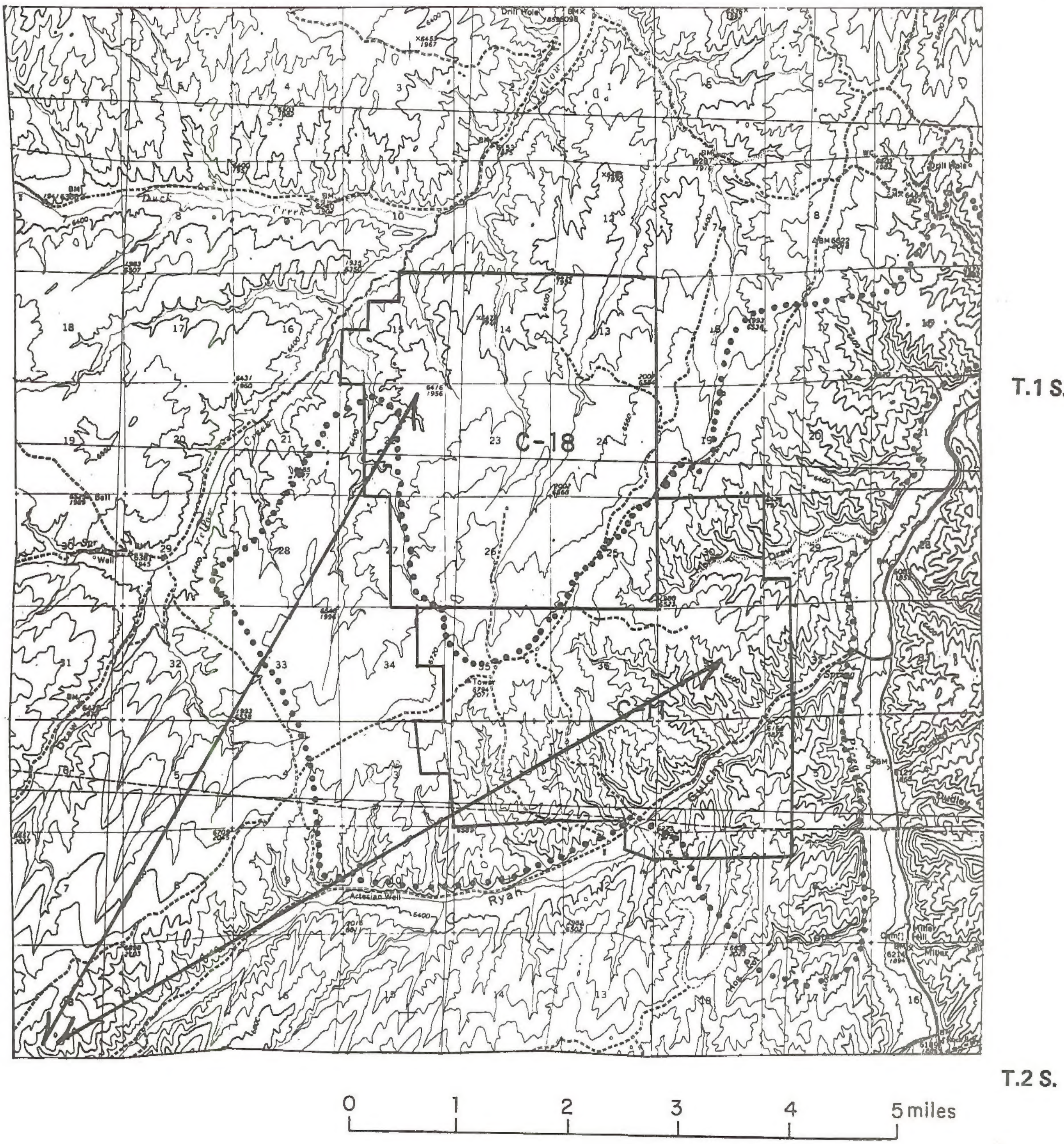



Proposed Prototype Oil Shale Lease Tracts

**Figure III-12 Range Management Facilities**

R. 98 W.

R. 97 W.




Note: Entire area is mountain lion winter range. Entire area outside critical winter range is mule deer winter range.

**Figure III-13 Big Game Seasonal Ranges and Migration Routes**

upper elevation pinyon-juniper winter ranges where greater browse production occurs. During harsh winters of sub-zero temperatures, windy conditions, and heavy snowfall, deer are forced to these lower elevation critical ranges where forage is more accessible on southern exposures with less snow accumulation.

BLM/DOW management objectives are to maintain a wintering population of 40,000 deer in Piceance Basin. This correlates to population densities of 54 and 80 deer per square mile on winter and critical winter ranges of the tracts, respectively.

Douglass et al (1981) calculated 1980 to 1981 winter range average densities on-tract to be 67 deer per square mile in the chained pinyon-juniper, 27 deer per square mile in the pinyon-juniper habitat, and 13 deer per square mile in sagebrush and greasewood-sagebrush bottom habitats.

Seasonal use areas for mountain lion coincide with those used by mule deer, their primary prey source. Average animal density for Piceance Basin winter range is four lions per 100 square miles. Elk occur on these tracts in low populations during winters of adverse weather conditions.

#### Raptors

One golden eagle nest on Tract C-11 has been active three times during the period 1975 to 1981. Two additional inactive cliff nests of poor condition (possibly red-tailed hawk) are located on each tract (Douglass et al 1981). Location of known raptor nests is available upon request from the BLM in Meeker. Although unknown at this time, it is highly probable that accipiters and owls nest in the pinyon-juniper woodlands on these tracts. Raptors commonly present in winter are golden eagles, red-tailed hawks, marsh hawks and rough-legged hawks.

#### Birds, Mammals, Reptiles, and Amphibians

Waterfowl seasonal use areas are associated with aquatic environments of perennial water along Piceance Creek and Yellow Creek. No known populations or potential habitat for migratory birds of high Federal interest occurs on these tracts. A list of other wildlife species known or expected to occur on the tracts with a brief, general description of each species habitat preference is available in the Piceance Basin Unit Resource Analysis - Step 2 and Douglass et al (1981).

#### Wild Horses

Approximately 20 to 30 wild horses reside in pastures B and F of the Square S Allotment. The objective of the White River Resource Area's Wild Horse Management Plan includes complete removal of horses from these two pastures by 1988.

### Aquatic

The U.S. Fish and Wildlife Service (USFWS) and DOW have classified all streams within the affected area as limited game fisheries potential of low resource value. The White River downstream from Rio Blanco Lake is classified both as an endangered species fishery and as a limited game fishery.

These drainages are dominated by species from the Families *Catastomidae* (suckers) and *Cyprinidae* (minnows). Very few game fish species are present, except in the upstream portions of the White River, Piceance Creek and its major tributaries (Black Sulphur, Fawn, Willow and Stewart Creeks).

No major stream/pond aquatic habitats occur on Tracts C-11 or C-18.

### Threatened and Endangered Species

Six species were presented in the list received from USFWS for analysis in the biological assessment. It was determined that no populations or suitable habitat for black-footed ferret, whooping crane and peregrine falcon are present within the tract areas.

Bald eagles reside in the White River valley from October through March as winter residents and migrants. Core populations in winter vary from 50 to 70 birds, with migratory peaks of up to 160 birds in March. Bald eagles roost in cottonwood stands and Douglas fir stands along the White River and forage in upland areas. Foraging eagles are evident throughout Piceance Basin during the winter months, but no high use or preferred areas has been defined.

It has been regularly documented that Colorado River squawfish occur in the White River. The Colorado segment of the White River is considered habitat for juvenile and adult squawfish. Apparent importance of the White River to endemic fish in the Upper Colorado River Basin is quantity and periodicity of water flow.

There is one report of a humpback chub from the White River (Sigler and Miller 1963). However, the Colorado River Fishes Investigation Team, established in April 1979, has not found recent evidence of this species inhabiting the White River.

# CULTURAL RESOURCES

## Tract C-11

Sixty-six percent of Tract C-11 has been surveyed at the Class III inventory level for cultural resources. This survey, which was performed by the Laboratory of Public Archaeology (Weber et al April 1977), covered approximately 3,350 acres. Sixteen sites and 13 isolated finds were recorded. Of these sites, none are presently listed on the National Register of Historic Places, four are considered eligible, one may be eligible, ten are not eligible, and the eligibility status of one site is unknown. Based on data from the area which has been surveyed to date, the ratio of known cultural resources per acre inventoried for Tract C-11 is 1:116. This is considered moderate when compared with data from other areas within the White River Resource Area.

## Tract C-18

Thirty-nine percent of Tract C-18 has been inventoried for cultural resources. Of a total of approximately 1,980 acres, 1,880 were inventoried by Grand River Institute (Conner and Langdon January 1981) and 100 acres were inventoried by miscellaneous contractors for the permitting of several wells and access roads. A total of 18 sites and 15 isolated finds have been recorded within the tract boundary of these sites; the Duck Creek Wickiup Village (5RB53) is listed on the National Register of Historic Places, three are considered eligible, two may be eligible, three need more data before eligibility can be assessed, five are not eligible, and the eligibility status of one site is not known. The ratio of known cultural resources per acre inventoried for Tract C-18 is 1:60. This would indicate that there are a greater number of potential cultural sites to be encountered on Tract C-18 than on C-11 even though less area has been inventoried. A 100 percent Class III pedestrian survey (Environmental Stipulations of the lease, Section 6), conducted prior to any surface disturbance as a result of the proposed action, could verify this.

## Predictive Model

The consulting firm of Gilbert/Commonwealth is currently under contract to the Bureau of Land Management for a cultural resource study in the Piceance Basin including the proposed lease tracts. The general purpose of this study is to generate cultural resource data of area-wide suitability for planning for projected oil shale development. Specific objectives include:

1. Recognition or elaboration of patterns of past human use and occupation;

2. Development of projections of expected density, distribution, and diversity of cultural resources;

3. Identification and assessment of the environmental and/or cultural variables or combination of variables that form the most accurate predictors of cultural resource sites;

4. Determination of research direction for the study areas that will provide guidance for future research and a basis for formulating and evaluating mitigation plans (Newkirk et al 1982).

This study, due to be approved by BLM in January 1983, will provide a predictive model which can be used to determine the likelihood of encountering cultural resources on a site-by-site basis. If the model generated predicts site locations within a statistically acceptable range, it will be used in future land use actions.

# PALEONTOLOGY

Four geological units outcrop on Tracts C-11 and C-18. The oldest is the Thirteen Mile Creek tongue of the Green River Formation over which lay tongues 4 and 5 of the Uinta Formation (Duncan 1976). In addition to that, Pleistocene or Recent alluvium is found along some creek bottoms. These units are described in greater detail in the Geology section of this chapter.

These units are important for vertebrate and invertebrate fossils for several reasons. The Green River Formation is well known for its well preserved fish and insect fossils. The fish fossils are of special interest here because the Green River Formation in the Piceance Basin is slightly younger than it is in the better known fish fossil localities in Wyoming, and would be valuable in understanding the evolution of certain Eocene fish. These fish fossils may be encountered while sinking a shaft or while drifting, or crosscutting, at depth. They are not

likely to occur at the surface on these two tracts. The size of these fish fossils ranges from less than one inch to several feet, although the smaller ones (less than one inch to about four inches) are more common.

The insect fossils of the Green River Formation are abundant but unique in that usually they are very well preserved. The size of these insect fossils are comparable to present day insects such as flies, ants, bees, larvae etc., and would be hard (if not impossible) to see from the top of earth moving equipment. Fish fossils would similarily be difficult to see. The Green River Formation also has an abundance of plant fossils such as leaf fragments which are of minor significance.

Tongues 4 and 5 of the Uinta Formation also contain both vertebrate and invertebrate fossils. Tongue 5 covers the majority of the surface area within Tracts C-11 and C-18. In this unit most of the vertebrate fossils are medium to large in size, representing relatives of the horse, rhinoceros and tapir, however smaller mammals (such as mongoose-like mammals) are also represented by jaws and teeth or parts thereof.

The insects and plant fossils found in tongues 4 and 5 of the Uinta Formation are significant in that late Eocene plant fossils are rare, and late Eocene insect fossil localities were unknown in the United States before 1978. These fossils seem to be concentrated in lenses of mudball conglomerates. Research or exhibit quality vertebrate fossils can be found at about every 400 to 500 yards of outcrop.

No detailed study of the fossil vertebrates of the Piceance Basin exists, however, references to these fossils can be found in several publications, making them time consuming and difficult to locate and reference. One of the objectives of the paleontological inventory and survey currently being performed in the Piceance Basin, is to consolidate these scattered references together in a useful volume. That information will be available in October 1982.

A paleontological resources inventory and evaluation was done by Dr. Peter Robinson (1978) for the Bureau of Mines Horse Draw Project which covers the northeastern part of Tract C-11. This survey revealed two Brontothere skulls, which were not collected, along with several limb bones, teeth and assorted bone fragments. A bison skull and isolated tapiroid teeth were also found. Many plant fossils, some of which were rare late Eocene plants, were collected along with one late Eocene insect larvae. A detailed list of the fossils found, their quality, location and importance can be found in the referenced survey. A good quality miacidae jaw was found less than two miles from the northwest corner of Tract C-18. It is expected that fossils of similar quality and importance might be found throughout Tracts C-11 and C-18.

## VISUAL RESOURCES

In 1978, the White River Resource Area was inventoried for an evaluation of its visual resources. The evaluation consisted of a three step assessment of 1) the visual quality of the landscape, 2) the sensitivity of the area with regard to the number of viewers, and 3) the distance that the viewed area is seen from major transportation routes.

Scenic quality is perhaps best described as the overall impression retained after driving or walking through an area. Each area is rated by seven key factors: land form, vegetation, water, color, influence of adjacent scenery, scarcity and cultural modification. The values for each category are calculated and, according to total points, three scenic quality classes are determined and mapped:

**Class A** - Areas that combine the most outstanding characteristics of each rating factor (19 - 33 points).

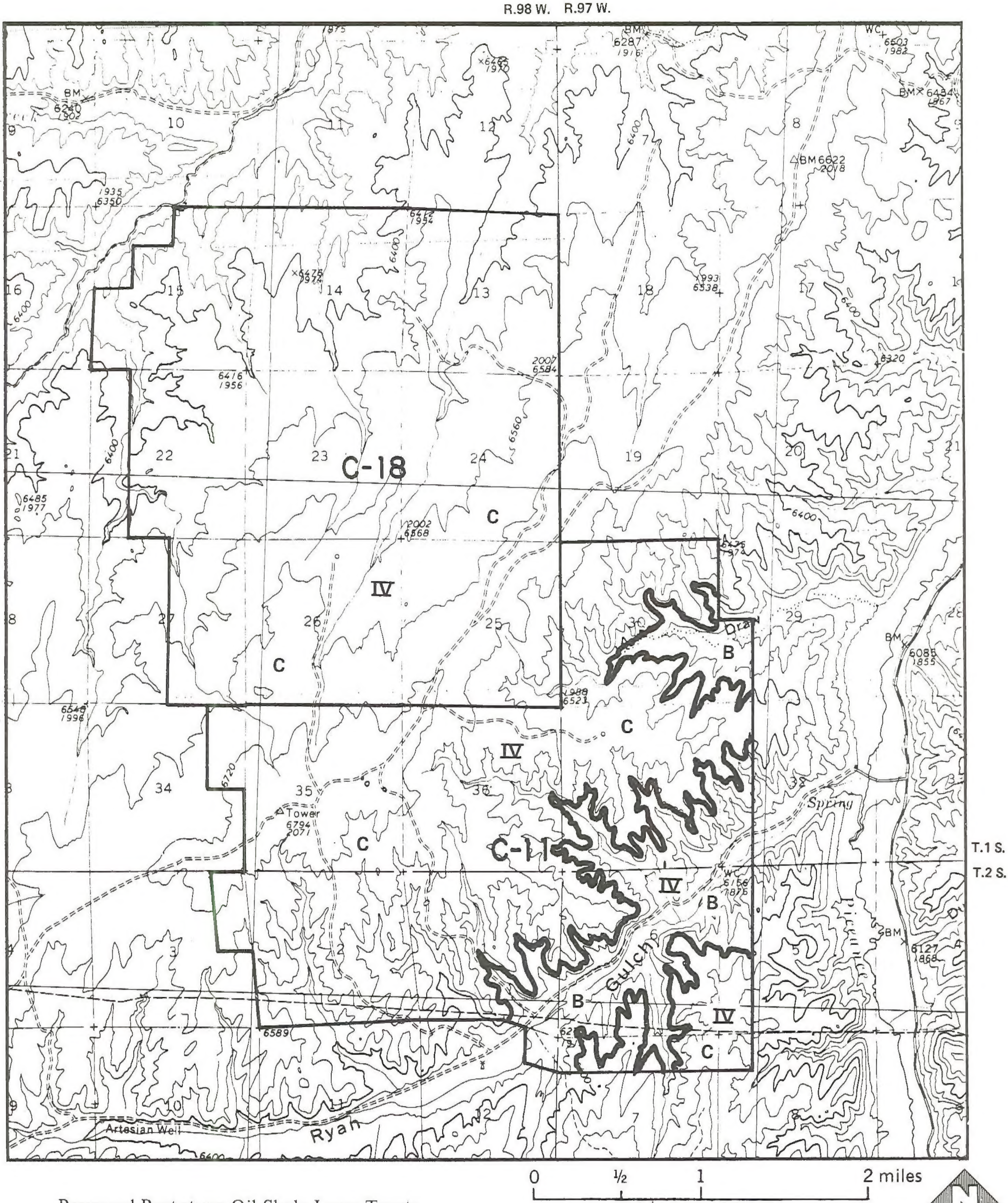
**Class B** - Areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region (12-18 points).

**Class C** - Areas in which the features are fairly common to the physiographic region (0-11 points).

Sensitivity was determined by use volume. Frequency of travel through an area and the local use of that area was tabulated. The area was then assigned a high, moderate or low rating according to predetermined classifications.

Related to the sensitivity rating is the distance zone. The visual quality and the sensitivity of a landscape may be magnified or diminished by the visibility of the landscape from major viewing routes. Major routes are B Class County Roads or better. The only major route near the tracts is County Road 5, Piceance Creek Road. It is located approximately one-half mile from the eastern boundary of Tract C-11 and one and a quarter miles from the eastern boundary of Tract C-18. This would place most of the project development on lands which cannot be seen from Piceance Creek Road.

All of Tract C-18 and most of Tract C-11, except for Ryan Gulch, (see Figure III-14) are rated as "C" Quality. This area is characterized by rolling to occasionally steep hills. Numerous sandstone rock




Proposed Prototype Oil Shale Lease Tracts

Quality Ratings
A - Outstanding
B - Characteristic
C - Minimal

Visual Resource Management Class IV (Both Tracts)

**Figure III-14 Visual Resources Scenic Quality Ratings**

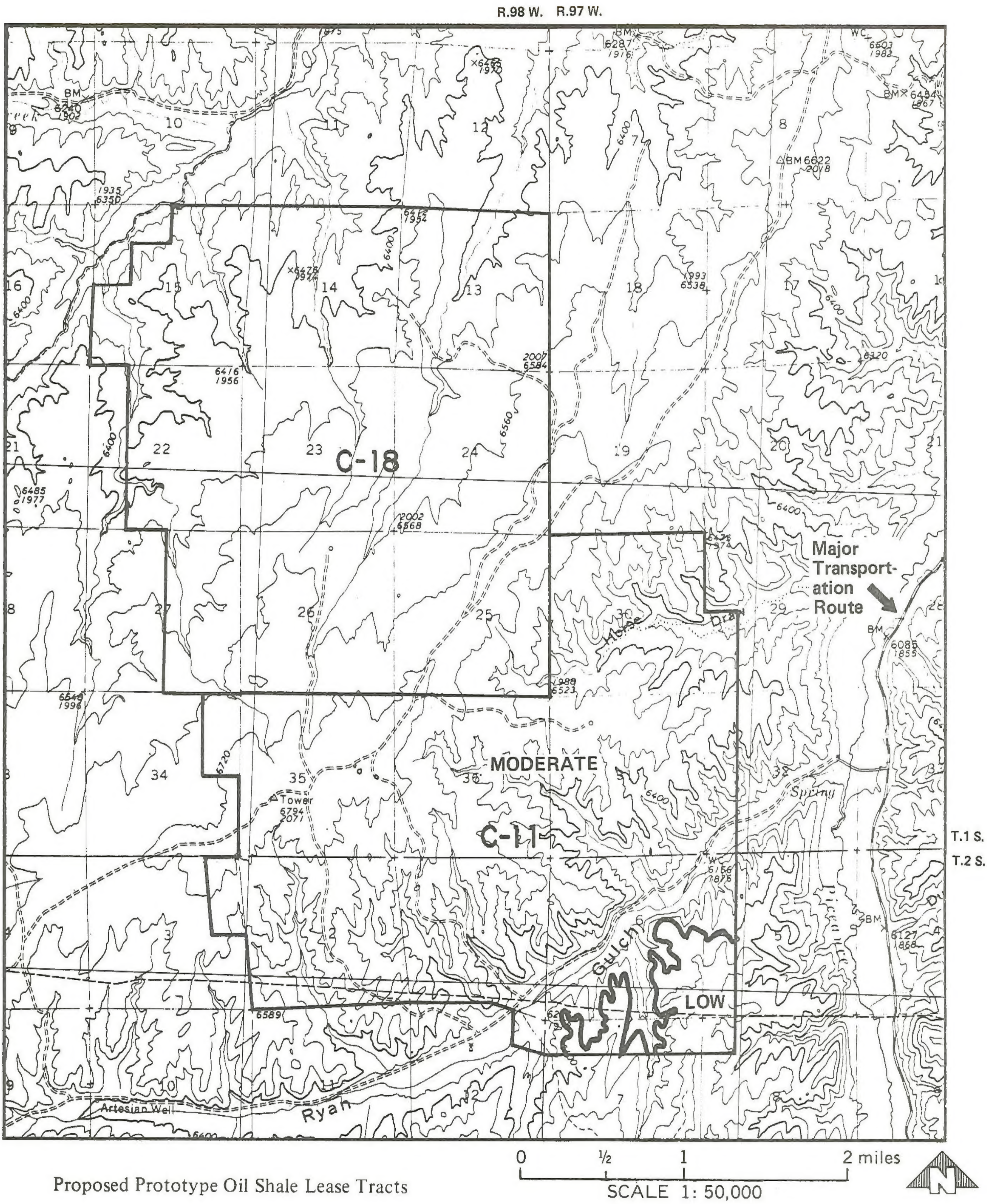



**Figure III-15 Visual Resources Sensitivity Zones**

outcrops occur within the landscape but generally do not create much interest due to their small scale. Vegetation is dominanted by relatively dense stands of pinyon-juniper. Sagebrush and mountain brush species also exist to a large degree in the area. Out of a total possible score of 33 this area is rated 9.

The Ryan Gulch area is rated as "B" Quality. This area is characterized by the meandering Ryan Creek floodplain. Vegetation consists primarily of grasses and sagebrush. Out of a possible score of 33 the area is rated 12.

All of Tract C-18 and most of C-11 is rated as having moderate sensitivity. The southeastern corner of C-11 is rated as low sensitivity (see Figure III-15).

The three components: scenic quality, sensitivity, and distance zones, are compiled to formulate management classes. These classes are divided into five levels: I, II, III, IV, and V. The degree of contrast allowed varies with Class I being the most restrictive (e.g. designated wilderness areas) and Class IV the least restrictive. Class V is an interim classification for landscapes in need of rehabilitation or where management practices have reduced landscape quality.

Both tracts are in management Class IV. In Class IV, contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements inherent in the landscape whenever feasible.

## RECREATION

The current (1979 to 1980) recreation use of the area is predominantly hunting. Big game hunting use is indicated by big game hunting unit 22; a 1,038 square mile area, located between Cathedral Bluffs to the west, Highway 13/789 to the east, Highway 64 to the north and the Roan Cliffs to the south. the proposed tracts are located near the center of this unit. Small game hunting use is measured by small game hunting unit 22, a 1,930 square mile area, located between the Utah state line to the west, Highway 13/789 to the east, Highway 64 to the north and Roan Cliffs to the south. The proposed tracts are located near the east/central portion of this unit.

Mule deer and elk hunting dominate the big game sports. For deer hunting in 1980, 1,197 residents of Colorado and 2,147 out-of-state hunters utilized unit 22 for a total of 13,060 recreation days. A recreation day is any portion of a 24 hour day used for recreational purposes by one person.

Total big game hunting use for this unit, to include bear and lion, for 1980 was 4,385 hunters using 17,634 recreation days. Deer season ran from August 30 to November 5. Elk season ran from August 30 to November 11.

Rabbit hunting dominates the small game hunting sports. In 1979, 1,065 hunters used the area for hunting rabbits and hares for a total of 3,774 recreation days. Total small game hunting, to include waterfowl, included 1,844 hunters using 10,751 recreation days.

Hunting use trends in the Piceance Wildlife Unit are on the upswing. Animal populations are recovering from previous declines due to winter kills. Based on animal management projections (see Chapter III, Wildlife) recreation use will likely increase 50 to 60 percent over the next two to three years then level out to a steady five to seven percent increase annually, if existing conditions persist.

## WILDERNESS

In November 1980, an intensive wilderness inventory was completed for the White River Resource Area. No Wilderness Study Areas were identified in the Piceance Basin Planning Unit.

In addition, no designated Wilderness Areas are located in the Resource Area. The nearest designated Wilderness Area is the Flat Tops, located in White River National Forest, 40 miles to the east. The nearest administratively approved Wilderness Study Area is Dinosaur National Monument, located 36 miles to the north (see Figure III-1).

## SOCIAL

Seven towns would experience population growth from the proposed development: Glenwood Springs, Rifle, Silt, Parachute, Grand Junction, Rangely, and Meeker. Of these, Parachute and Grand Junction would not be significantly affected.

### Silt

Silt grew from 380 to more than 1,000 persons between 1970 and the summer of 1981, (most of it since 1980) because it provided lower cost housing for service workers in tourist areas to its north and east, and to oil shale projects in the Parachute-De-

Beque area to the west. Silt may be shifting from an independent small town, within the shopping district of Glenwood, to a bedroom community serving both Glenwood and Rifle. Officials in Silt have tapped oil shale trust funds to improve the town's facilities because they expect the population will reach 3,500 within a few years.

Typical of rapid growth, political and service structures have become more formal. Law enforcement, in 1970 composed of only a town marshall, now consists of a full-time and a part-time deputy, and three reserve officers on call. A rise in crime seems to be general. One minister reported a rise in marital counseling, generated in part by the stress that comes when newcomers do not easily find jobs in the area.

## Glenwood Springs

Glenwood Springs, (pop. 6,000) is primarily oriented toward tourism -- skiing, the famous hot springs bathing, and other outdoor sports. Its geographical location in a narrow scenic canyon and its refusal some years ago to permit a highway bypass causes downtown congestion and noise. New growth is confined to the Roaring Fork valley southward, and Colorado River valley westward.

The hiring of professional planners is strong evidence that local government decision making processes are becoming more formal. This has brought some conflict between longtime town leaders and those newer to the area who more readily accept the new expertise.

Because of its desirable location, Glenwood has many health practitioners. The regional hospital has a high use rate which may mean new facilities will be needed in a few years.

The entire county is served by a very active mental health regional center with branches in surrounding communities. In recent years, the services have greatly expanded, as needs have continued to grow. Mental health officials report case load increases. The center is also developing prevention programs in the region.

Law enforcement has expanded and become more formal and professional, although low salaries make it difficult to hold trained personnel. There is an alcohol treatment facility in the town. Police officials estimate that the influx of energy workers has brought no problems beyond their proportion in the population.

The public schools have somewhat declining enrollments, an anomaly in view of the growth. Increases in discipline problems have brought formation of a Parent Advisory Committee to help find solutions. A high student turnover rate (20 to 30 percent in and out during the year) has brought some problems.

Among the outstanding changes in the social structure has been the growth of the Colorado Mountain College program. Headquartered in Glenwood, it serves several counties through its branches. It provides a highly innovative junior college program tailored to the needs of the area, plus some upper division and graduate courses in cooperation with other state colleges. The college has seen very strong growth from 4,355 to more than 25,000 students in the years 1969-70 to 1979-80. In addition to academic and trade/technical courses, the college has also developed training in human services delivery and engaged in these services directly -- counseling and communications, senior citizen consortium for human services education, and programs directly related to western slope energy development. The county government in Glenwood Springs is rapidly formalizing.

## Rifle

Rifle was at the center of an "oil shale boom" at least twice before the present -- in 1913 and again in the late 1940's, though in each instance the boom was more in expectations than in reality. The skepticism growing from those times made the community doubtful that oil shale would "go" in the 1970's and 1980's. Only recently did skepticism give way to belief -- just in time to be shattered by the slow-down of oil shale development in the region.

Rifle has prepared for growth by various funding methods. Boom conditions have existed since the late seventies as population increases began producing shortages and congestion as well as some better shopping facilities, expansion and improvement of social services delivery systems such as mental health, a newcomer integration project, a branch of Colorado Mountain College, and programs for the elderly. A $100 million Human Services building is being planned for Rifle, in which space would be free to services providers.

Other responses to structual pressures have also occurred. Efforts to control downtown congestion on Railroad Avenue (Hwy. 13 north-south) have caused some citizen/local government conflicts because of disagreements regarding a by-pass route. In the most recent local election (late 1981), three of five new council members were new residents, evidence that the political base is diversifying in

Rifle. Rifle has more than tripled its population since 1972.

According to a recent BLM (1981) study based on a random sample of 109 persons, the people of Rifle favor energy development by a two-thirds majority, but not at the expense of a deteriorating environment. Oldtimers feel the stresses of seeing their community become more congested and less psychologically comfortable, but in general they also see some advantages such as better employment opportunities for the younger population. They are glad for better shopping facilities, and they believe the country needs the oil. Respondents in this study saw the biggest problems as rise in living costs, traffic congestion, higher crime rates, and housing shortages. Fifteen percent were concerned about the natural environment.

Twenty-nine percent of the respondents felt that local communities have no influence on whether energy production occurs in the area, 41 percent felt they had very little influence, 13 percent said some, and 17 percent said a lot. In-depth interviews with 22 of the respondents revealed, however, that some persons do not believe the local community should have much influence in such decisions. The most common view expressed was that a community should not be able to stop development, but that it should be able to impose mitigative restrictions on the companies.

Of things liked most about living in Rifle, respondents most often mentioned friendliness of the people, natural beauty of the area, climate, outdoor recreation, and small size of the town (23 percent). Those holding energy jobs and newcomers were less likely to mention friendliness of the people. Newcomers often felt that they were not warmly received by the town, and that oldtimers were too suspicious of them.

In-depth interviewees ranked wildlife as of highest priority, with watershed second. The other four choices (range, timber, recreation, and energy and minerals) were of about equal rank.

## Meeker

Meeker traditionally was a scenically located small, isolated ranching community with a hunting-fishing tourist trade in fall and summer. But it, like Rifle, has lived in the shadow of energy development for 80 years. Only since 1975 has the activity seemed certain enough to erode the skepticism of lost expectations from the past.

By about 1980, a general spirit of either resignation to, or active acceptance of, energy growth was beginning to prevail. Local and county governments were developing a more formal structure to provide for growth management. A city manager and professional planners were hired, oil shale trust fund and other impact monies were obtained, and an advisory group of local leaders, business, government, industry and human service representatives was formed. A Human Resources Council was started to draw together coordinative planning, and identify needs. A recreation survey and plan were developed.

Additional housing of various price ranges was built at a rapid pace; social services, such as mental health, aid for the handicapped, and a branch of Colorado Northwest Community College, were all being added or expanded. Some conflicts among various interest groups and some competition for funding have of course been inevitable.

The "boom" conditions which bring about social changes with their individual social-psychological stresses have now slowed in Meeker. Leaders now have concern for surplus housing, unemployment, etc.

A 1981-82 ongoing study of social impacts upon Meeker (Lillydahl et al. 1982) indicates that the people of Meeker continue to treasure their beautiful natural environment with its clean air and clean water.

A 1975 study of 350 Meeker residents showed that while they generally considered growth to be inevitable, 18 percent preferred no growth at all, while 60 percent preferred growth to 3,000 to 5,000, only five percent wanted Meeker to grow to more than 10,000. Significantly, 51 percent favored the establishment of a new town close to the mine sites of Piceance Basin. The same question asked today would probably show somewhat different results.

One local conflict of importance is between the community and an out-of-state development organization, the Bar 70 Enterprises, which seeks to build up to 5,000 new housing units for some 20,000 persons over the next 20 years, on a large tract on the east side. The local newspaper provides a running account of the conflicts, and apparently the general fear is that such a large development would totally change the character of the town, and "What would that many people do here?"

Thus Meeker has been in a boom growth pattern for several years but is currently in a slump. If the slump ends within a reasonable time -- say one to two years -- it is probable that its occurrence will give the community the breathing spell necessary to catch up sociologically with the changes that have occurred.

## Rangely

Rangely is more isolated, less scenic, more arid, and has a very different historical setting than Meeker. Distance from other Colorado towns has caused it to orient more to the Vernal, Utah, area, a tie made more firm recently by the Western Fuels Coal operation a few miles east of town. Coal is to be taken by electric railroad to the Deseret Generating plant near Bonanza, Utah.

The drier climate supports less ranching and little tourism.

Rangely's population jumped from 100 or so to 5,000 during the oil and gas boom of World War II. Rangely is thus a younger town than Meeker, has always been an energy town, and its traditions did not grow out of the usual ranching society of northwest Colorado. The town has always struggled to retain its population, and both prepared for and welcomed energy development during the late 1970's when energy independence became a national priority.

Among Rangely's preparations for growth was a Recreation District that obtained financing for the most complete recreation facility in the region. Colorado Northwest Community College has put together a technical program geared specifically to energy production; the hospital and schools have low occupancy rates so can absorb considerable growth; planning, zoning, and stipulations on Western Fuels for front-end financing, have made possible further social and economic impact mitigations. Housing has continued to be in short supply, but recent purchases of land from BLM will make possible further expansion of the community.

Practical and political problems over building a good road to Rangely from C-a Tract continue to obstruct additional population from oil shale operations in Piceance Basin, and a similar lack of a good road limits the numbers of Deseret Power Plant workers who might otherwise live there rather than in Jensen or Vernal.

Rangely has shared with Meeker the establishment of the county-wide Advisory Group and the Human Resources Council. Some services formerly based in the county seat of Meeker now have branches in Rangely (for instance, the Mental Health Clinic). The two communities share law enforcement also.

The slump which has affected Meeker and Rifle has not been a big factor in Rangely because it had fewer workers in oil shale, and also because of the influx of workers for the Western Fuels mine.

No up-to-date attitude studies are available for Rangely, but there probably now exists some concern about rapid growth, a shift from the highly positive orientations and preparations which prevailed until very recently.

A discussion of social impact processes and their causes is presented in Chapter IV. From it, the existing "boom" situation described here for the five significantly affected communities can be delineated and evaluated for on-going impacts from the alternatives.

# ECONOMICS

## Impacted Area

Economic data is available only by county. Therefore, an impacted area for economic analysis has to be defined in terms of whole counties. The impacted area for this analysis consists of Garfield, Mesa, and Rio Blanco Counties. Although the proposed tracts are located in Rio Blanco County, a majority of the work force in neighboring prototype Tracts C-a and C-b lives in Garfield County, and it is likely that this pattern will continue. Grand Junction, in Mesa County, is the regional business and retail center and receives a large portion of the secondary impacts from oil shale and other projects. Because the southward patterns of commuting and purchasing are expected to continue, little impact is projected for adjacent Moffat County to the north and Uintah County, Utah to the west.

## Employment and Income

Employment and income figures from 1980 are shown in Table III-10. The construction and mining industries are listed separately because these are where the primary impacts would occur. Secondary impacts would be scattered over a number of other industries.

The figures in Table III-10 are by place of residence. For this reason they will differ from most other employment and income figures, which are by place of work and do not take commuting into account.

Both Garfield and Mesa Counties have diversified economies. Garfield county has an important tourist trade. Mesa County is a business and manufacturing center and has a large agricultural sector. Rio Blanco County, in contrast, has a major part of its present economy based on mineral development. Livestock production remains an important factor in

TABLE III-10
1980 EMPLOYMENT AND INCOME

| | Number | Percent of Total |
|---|---|---|
| Garfield County | | |
| Total Employment | 11,340 | 100.0 |
| Construction | 1,241 | 10.9 |
| Mining | 693 | 6.1 |
| All Other | 9,406 | 83.0 |
| Total Labor Income (000) | $145,886 | |
| Mesa County | | |
| Total Employment | 36,607 | 100.0 |
| Construction | 2,733 | 7.5 |
| Mining | 2,121 | 5.8 |
| All Other | 31,753 | 86.7 |
| Total Labor Income (000) | $492,875 | |
| Rio Blanco County | | |
| Total Employment | 4,789 | 100.0 |
| Construction | 1,097 | 22.9 |
| Mining | 1,563 | 32.6 |
| All Other | 2,129 | 44.5 |
| Total Labor Income (000) | $91,714 | |

Source: BLM estimates derived from:
Colorado Division of Employment and Training. Colorado Manpower Review.
US Bureau of Economic Analysis. Regional Economic Information System.

TABLE III-11
1980 POPULATION

| | County | Census County Division | Community |
|---|---|---|---|
| Garfield County | 22,514 | | |
| Glenwood Springs Division | | 12,394 | |
| Carbondale | | | 2,084 |
| Glenwood Springs | | | 4,637 |
| Grand Valley Division | | 956 | |
| Parachute | | | 338 |
| New Castle Division | | 3,943 | |
| New Castle | | | 563 |
| Silt | | | 923 |
| Rifle Division | | 5,221 | |
| Rifle | | | 3,215 |
| Mesa County | 81,530 | | |
| Clifton Division | | 13,682 | |
| Palisade | | | 1,551 |
| Grand Junction Division * | | 54,222 | |
| Grand Junction * | | | 28,144 |
| Other Divisions * | | 13,626 | |
| Rio Blanco County | 6,255 | | |
| Meeker Division | | 3,642 | |
| Meeker | | | 2,356 |
| Rangely Division | | 2,613 | |
| Rangely | | | 2,113 |

* Ten persons in Grand Junction live in the Fruita Division, but are shown here in the Grand Junction Division

Source: Colorado Division of Planning. 1980 Census Report Number 2.

all three counties, but has become small numerically compared to the other developments. Rio Blanco County also has a tourist trade, dominated by fall hunting and summer mountain recreation.

## Population

Table III-11 shows 1980 populations.

Mention needs to be made of Census county divisions. In cooperation with local officials, the Census Bureau divides most counties into two or more parts. Maps of the county divisions can be found in Population Census reports. In the impacted area, most of which is sparsely populated, the great majority of a county division's population is located in or adjacent to its communities. For this reason, and because city boundaries can readily be changed, it is believed that county divisions make a better base for projections than present city limits. Therefore, all projections will be for county divisions and should be compared to the 1980 division populations.

Because Grand Junction has a metropolitan-type development, the Clifton and Grand Junction Divisions are used to represent that area.

Uneven population distribution characterizes the impacted area. The majority is located in the Grand Junction area of Mesa County. Garfield County's population is heavily concentrated in the central and eastern parts of the county. Settlement in Rio Blanco County is clustered around its two communities. Areas between these population nodes consist of sparsely settled ranching country and unpopulated national forest.

Recent rapid growth has occurred in most of the population centers, for differing economic reasons as described in the section on employment. Grand Junction is the regional business and supply center and is experiencing a continuing growth in energy industry administrative offices. Carbondale and Glenwood Springs in eastern Garfield County are tourist oriented, with growth occuring in both summer and winter activities and in recreation home development. The four communities in the center of Garfield County are presently being impacted by oil shale projects (and will probably continue to be). Meeker's growth rate has slackened because of slow downs in local coal and oil shale projects, but Rangely is experiencing a continued growth from conventional oil and gas development. Except in the Grand Junction area, all of these communities are small and, thus, are highly subject to the impacts of large scale projects.

A commuting pattern has been established in which workers at the oil shale projects in Rio Blanco County reside primarily in the central Garfield County communities, particularly Rifle. Company busing is a main reason for this pattern, along with the limited retail and service facilities in Rio Blanco County.

## Housing

Housing data from the 1980 Census is shown in Table III-12.

Vacancy levels indicated in the table may not be very meaningful. Current growth is putting pressure on the housing supply in most of the communities, especially those in central Garfield County. Considerable new housing has been built since 1980 in those communities as well as the Glenwood Springs-Carbondale and Grand Junction areas. Also, housing vacancies will include a number of older units in poor condition that are not suitable to include in the future housing supply.

## Other Impacted Industries

### Agriculture

Livestock production is the principal agricultural activity in Garfield and Rio Blanco Counties. Crop production is dominated by hay for livestock use. Available statistics do not show earnings from livestock production. Preliminary 1980 figures on earnings from crop production are $6,060,500 in Garfield County and $2,906,500 in Rio Blanco County.

Mesa county has an important fruit growing industry in addition to livestock production and hay. Crop production earnings in 1980 totaled $22,333,000, about one-fourth of which came from vegetables.

Irrigation is important to agriculture in the region's dry climate, but more so in Garfield and Mesa Counties than in Rio Blanco County. Slightly over one-half of Rio Blanco County's harvested acreage in 1980 was irrigated, mostly hay. Some pasture is also irrigated, but the amount is not recorded.

### Recreation

Hunting is the only significant recreation activity on the proposed tracts. In 1979, an estimated total of 126,300 days were spent by hunters in Rio Blanco County. At an average of $6.62 per day in 1980 dollars (derived from an input-output model of northwest Colorado), the economic value to the

TABLE III-12
1980 HOUSING UNITS

| | Occupied | Vacant |
|---|---|---|
| Garfield County | 8,131 | 1,214 |
| Carbondale | 724 | 106 |
| Glenwood Springs | 1,930 | 230 |
| New Castle | 233 | 22 |
| Parachute | 129 | 15 |
| Rifle | 1,170 | 200 |
| Silt | 331 | 26 |
| Unincorporated | 3,614 | 615 |
| Mesa County | 29,668 | 2,905 |
| Grand Junction | 11,766 | 940 |
| Palisade | 585 | 72 |
| Other & Unincorporated | 17,317 | 1,893 |
| Rio Blanco County | 2,104 | 420 |
| Meeker | 846 | 135 |
| Rangely | 684 | 59 |
| Unincorporated | 574 | 226 |

Source: Colorado Division of Planning. 1980 Census Report Number 2

TABLE III-13

1980 COMMUNITY REVENUE SOURCES

| | Carbondale | Glenwood Springs | New Castle | Parachute | Rifle | Silt | Grand Junction | Meeker | Rangely |
|---|---|---|---|---|---|---|---|---|---|
| Source of Revenue (%) | | | | | | | | | |
| Local 1/ | 92 | 95 | 75 | 87 | 87 3/ | 75 | 93 | 67 | 73 |
| State 1/ | 5 | 3 | 23 | 11 | 3 3/ | 20 | 4 | 30 | 23 |
| Federal 1/ | 3 | 2 | 2 | 2 | 10 3/ | 5 | 3 | 3 | 4 |
| Assessed valuation | | | | | | | | | |
| Total (000) | $6,208 | $21,567 | $915 | $538 | $9,555 | $1,373 | $121,928 | $6,422 | $5,383 |
| Per capita | 2,979 | 4,651 | 1,625 | 1,592 | 2,972 | 1,488 | 4,332 | 2,726 | 2,548 |
| Total mill levy | 7.80 | 6.86 | 10.44 | 13.91 | 10.49 | 18.89 | 12.00 | 8.506 | 26.32 |
| Retail Sales | | | | | | | | | |
| Total (000) | $15,908 | $149,171 | NA | NA | $48,230 | NA | $670,252 | $16,835 | $38,172 |
| Per capita | 7,633 | 32,170 | NA | NA | 15,002 | NA | 23,815 | 7,146 | 18,065 |
| Sales Tax Rate (%) | 3.0 | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 1.0 | 1.0 |
| Bonded indebt. (000) 1/ | | | | | | | | | |
| General obligation | $81 | $2,070 | $180 | $0 | $981 3/ | $71 | $5,800 | $0 | $221 |
| Revenue | 1,397 | 415 | 0 | 0 | 18 3/ | 0 | 8,655 | 1,347 | 666 |
| Remaining bonding capacity (000) 2/ | 540 | 4/ | 0 | 54 | 4/ | 66 | 4/ | 642 | 317 |

NA: Not Available

1/ Figures include enterprise funds (water and sewer service, etc. but exclude large one-time federal and state grants.

2/ 30% of actual valuation (at 30% assessment rate equals 10% of assissed valuation) less general obligation bonds outstanding.

3/ 1979 data

4/ Home rule cities are exempt from bonding limit.

Source: Colorado Division of Local Government, 1980 Local Government Financial Compendium. Colorado Division of Property Taxation, Tenth Annual Report, 1980. University of Colorado, Business Research Division. Colorado City Retail Sales by Standard Industrial Classification, Calender Year, 1980. Colorado Department of Revenue, Annual Report, 1981.

county was about $840,000. Hunting of deer, the most economically important game animal, contributed some $440,000, or 52 percent of the total.

### Local Government Finances

Area communities obtain most of their revenues locally. As shown in Table III-13, local sources account for 67 to 95 percent of total community revenues. These figures appear high for two reasons: (1) they include enterprise funds, which are primarily funded by local charges, and (2) they exclude large state and federal grants, which are one-time items and not part of the normal budgets. This large dependence on local sources means that the communities can be highly impacted by developments that affect their tax base.

Rough measures of local funding sources are provided by per capita figures on assessed valuation and retail sales. They show that, in general, the larger communities have more susbstantial property tax bases, but that sales tax bases vary according to individual circumstances. The latter aspect is important because sales taxes make up from 18 to 48 percent of total community revenue (except in New Castle, which does not have one), with a median figure of 26 percent. Those communities having strong retail sales bases, generally because they are either business or tourist centers, will be in a better position to handle the financial impacts of growth.

At present, the communities' ability to increase these revenue sources is restricted. State law imposes a seven percent limit on annual increases in property tax revenues, and a four percent ceiling on combined municipal and county sales tax rates. Since only Rio Blanco County presently has a sales tax, most of the communities have some leeway to raise revenues by that means.

Figures on remaining bonding capacity in Table III-13 show how much major capital improvement could be funded from local resources. State law imposes the ceiling shown in footnote 2 of the table on community general obligation debt, except for home rule cities. With a couple of exceptions, the communities have more than half of their bonding capacity still available for use. However, rapid growth frequently imposes capital requirements in excess of most communities' local resources. Although state and federal assistance is often available for these needs, it is seldom enough to meet all requirements and involves the uncertainity inherent in seeking loan and grant awards.

## TRANSPORTATION

Three types of transportation facilities are addressed in this EIS: highways, railroads and pipelines.

### Highways

Major highways and county roads, which service the general area of the tracts, are Colorado 13/789 which runs from Rifle north to Meeker, Craig, and Wyoming; Colorado 64 which runs from Dinosaur to Meeker through Rangely; and Rio Blanco County Road 5, also known as Piceance Creek Road, which forms a loop between Colorado 13/789 and Colorado 64.

The affected highways are Colorado 13/789, between Rifle and Meeker; Colorado 64, between Rangely and Meeker; and Rio Blanco County Road 5. Figure III-16 shows the location of these highway segments. Highway use for these segments is currently well under capacity. Highway use, capacity, and accident statistics are given in Table III-14. Colorado 13/789 receives the most use, and also has the largest number of accidents.

Capacities for state highways are figured with traffic able to average about 50 miles per hour, and 40 miles per hour for county roads.

Peak hour traffic is the 30th highest amount of traffic that can be expected in an hour for the year. It approximates the above average rush hour traffic. The peak hour traffic/capacity ratio indicates approximate traffic conditions on the highway during high use. If this ratio is near 85 percent, momentary slowdowns in traffic will occur. If this ratio is near or over 100 percent, general traffic speed would be reduced to 40 miles per hour on state highways and 30 miles per hour on County Road 5. As can be seen in Table III-14, the volume of traffic on any given segment would have to increase greatly for any traffic congestion to occur.

An undetermined amount of pavement damage presently occurs on these highway segments, but there is no large scale trucking of any minerals to a railhead or pipeline terminal.

Planned improvements to local highways include the construction of a 22 mile gravel surfaced county road between the C-a Tract and Rangely and a by-pass on Colorado 13/789 to be built around Rifle.

TABLE III-14
AFFECTED HIGHWAY SEGMENTS (1980)

| Segment Letter | Description From/To | Segment Length (miles) | Daily Traffic | Peak Hour Traffic (PHT) | Highway Capacity at 50 mph | PHT/ Capacity rate (%) | Total Accidents per year | Fatal Accidents per 10 years |
|---|---|---|---|---|---|---|---|---|
| A 2/ | Colorado 13 from Rifle to Rio Blanco | 19.3 | 1,800 | 252 | 865 | 29 | 55 | 3 |
| B1 3/ | Southern half of Rio Blanco County Rd 5 | 19.0 | 300 | 40 | 850 1/ | 5 | 8 | 1 |
| B2 3/ | Northern half of Rio Blanco County Rd 5 | 20.0 | 200 | 30 | 850 1/ | 4 | 6 | 1 |
| C 2/ | Colorado Highway 13 From Meeker to Rio Blanco | 22.3 | 1,680 | 235 | 875 | 27 | 44 | 4 |
| D 2/ | Colorado Highway 64 From Meeker to County Road 5 | 17.1 | 740 | 104 | 820 | 13 | 18 | 2 |
| E 2/ | Colorado Highway 64 From Rangely To County Road 5 | 36.5 | 630 | 88 | 820 | 11 | 24 | 3 |

1/ Highway capacity at 40 rather than 50 miles per hour due to lower design standards.

2/ Source: Colorado State Department of Highways (1980a and b).

3/ Source: Cathedral Bluffs Shale Oil Company (Pysto 1982).

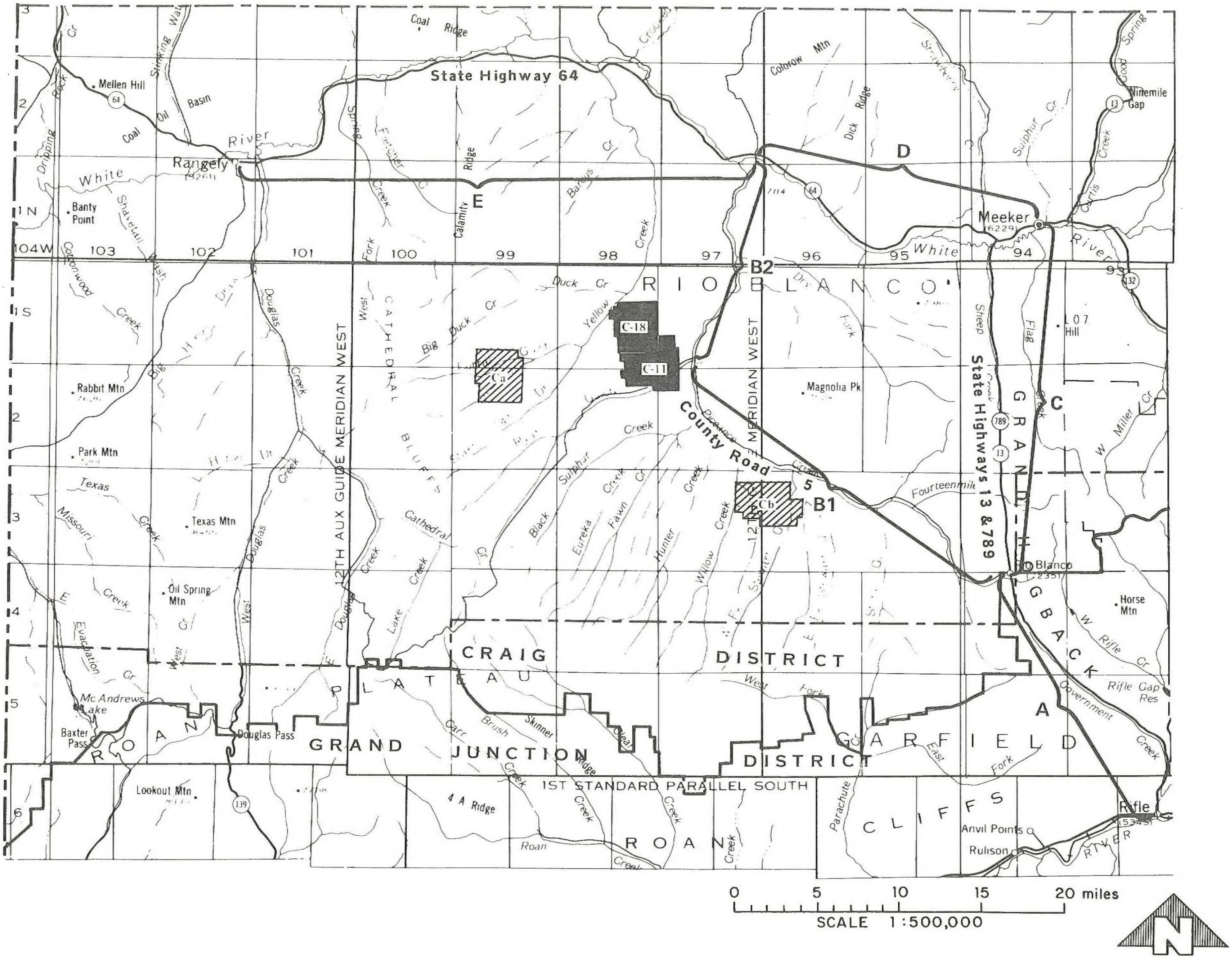



Figure III-16 Affected Road Segments

### Pipelines

There are presently no shale oil pipelines in the area. For shale oil to be transported with crude oil in crude oil pipelines it must first be "sweetened"by removing sulfur and arsenic along with other impurities. There are several crude oil pipelines in the area. An Amoco pipeline laid in 1947 between Salt Lake City and Casper, Wyoming passes within 35 miles of the tracts to the north near US Highway 40. This pipeline has a capacity of about 60,000 barrels per day.

A six inch Wesco pipeline built in the early 1950's runs between Bonanza, Utah and Loma, Colorado near Grand Junction. Approximately 4,000 barrels per day pass through this pipeline. Due to the age and small capacity of these pipelines, a large pipeline with a high capacity, suited to transporting shale oil would need to be built if any large scale production of oil shale began.

The La Sal Pipeline Company has proposed a pipeline to run from Exxon's Colony Oil Shale project near Parachute, Colorado to Casper, Wyoming. The pipeline would be 16 inches in diameter with a capacity of up to 150,000 barrels per day. While there are no firm plans for construction at this time, this pipeline or one similar would provide much of the needed capacity to transport shale oil out of Piceance Basin. One of the proposed laterals to the La Sal pipeline would cross the northern portion of Tract C-11 and the central portion of Tract C-18.

### Railroads

Two railheads are in this region. One is located south of Craig, Colorado, the other at Rifle, Colorado. Both are serviced by the Denver and Rio Grande Western Railroad, which services the area between Denver, Colorado and Salt Lake City, Utah. A rail system into Piceance Basin has been studied and evaluated, but no construction plans have been made (URS Engineers 1981).

## NOISE

Existing noise levels in the tract site areas are estimated to be 40 to 45 decibels (db). The existing level of noise along Colorado Highway 13/789, between Rifle and Rio Blanco and along Piceance Creek Road (County Road 5), between Ryan Gulch and Rio Blanco is estimated to be 69 db at 50 feet.

Noise sources on-tract are primarily natural, such as wind, but additional noise comes from aircraft and nearby roads. For comparison a normal suburban neighborhood would have a noise level of approximately 50 db, and a very noisy urban area would have a noise level of about 65 db (National Academy of Sciences 1977).

Noise levels, for the purpose of this analysis, were estimated using methodologies adopted from the National Academy of Sciences (1977), and the Department of the Air Force et al (1976).

## EXISTING RIGHTS

Five rights-of-way exist on Tracts C-11 and C-18. The rights-of-way consist of two buried natural gas pipelines, two access roads and a buried telephone line (see Figure III-17).

Three public water reserves exist on Tract C-11 (see Figure III-17).

One hundred percent of both tracts are currently leased or are about to be leased for oil and gas development. There is a total of twenty-five leases on the two tracts (see Figure III-18).

With the exception of four leases, all of Tract C-11 is currently leased for oil and gas development. Six of the leases have indefinite expiration dates due to established production for the oil and gas unit in which they are located. Three of the remaining leases will expire by 1987.

With the exception of one lease, all of Tract C-18 is leased for oil and gas development. Six of the leases have indefinite expiration dates due to established production for the oil and gas unit. Five of the leases will expire by 1988.

Both tracts are expected to be 100 percent leased for oil and gas development in one or two years. The four leases on Tract C-11 and the one lease on Tract C-18 that expired are currently listed as parcels to be leased again.

As stated in Chapter II, the Bureau of Mines has a research shaft located on the eastern portion of Tract C-11 (as shown in Figure II-1).

Approximately 4,557 acres of Tract C-18 is currently being leased to Wolf Ridge Corporation for the mining of sodium (Chapter II, see Figure II-1).

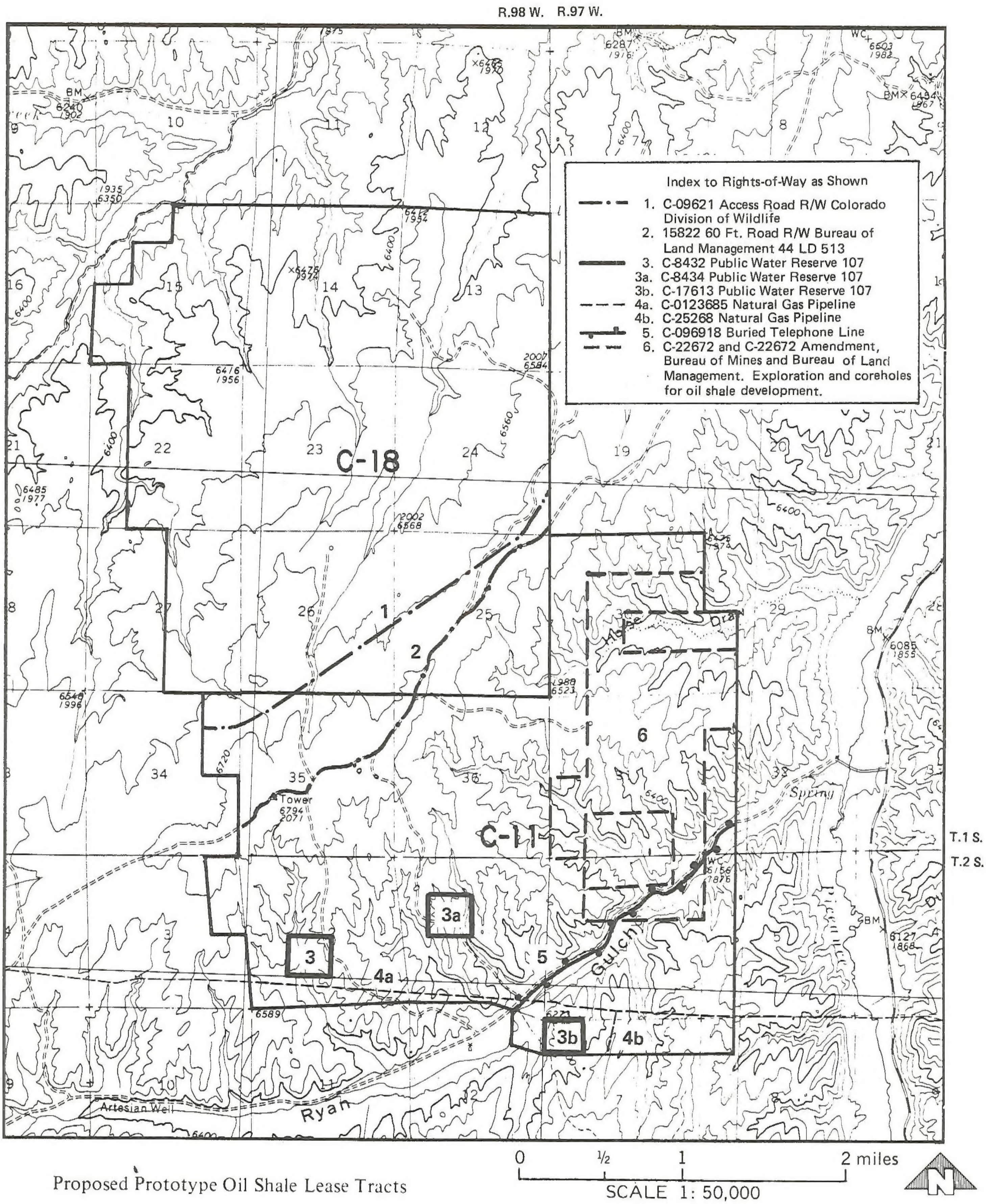
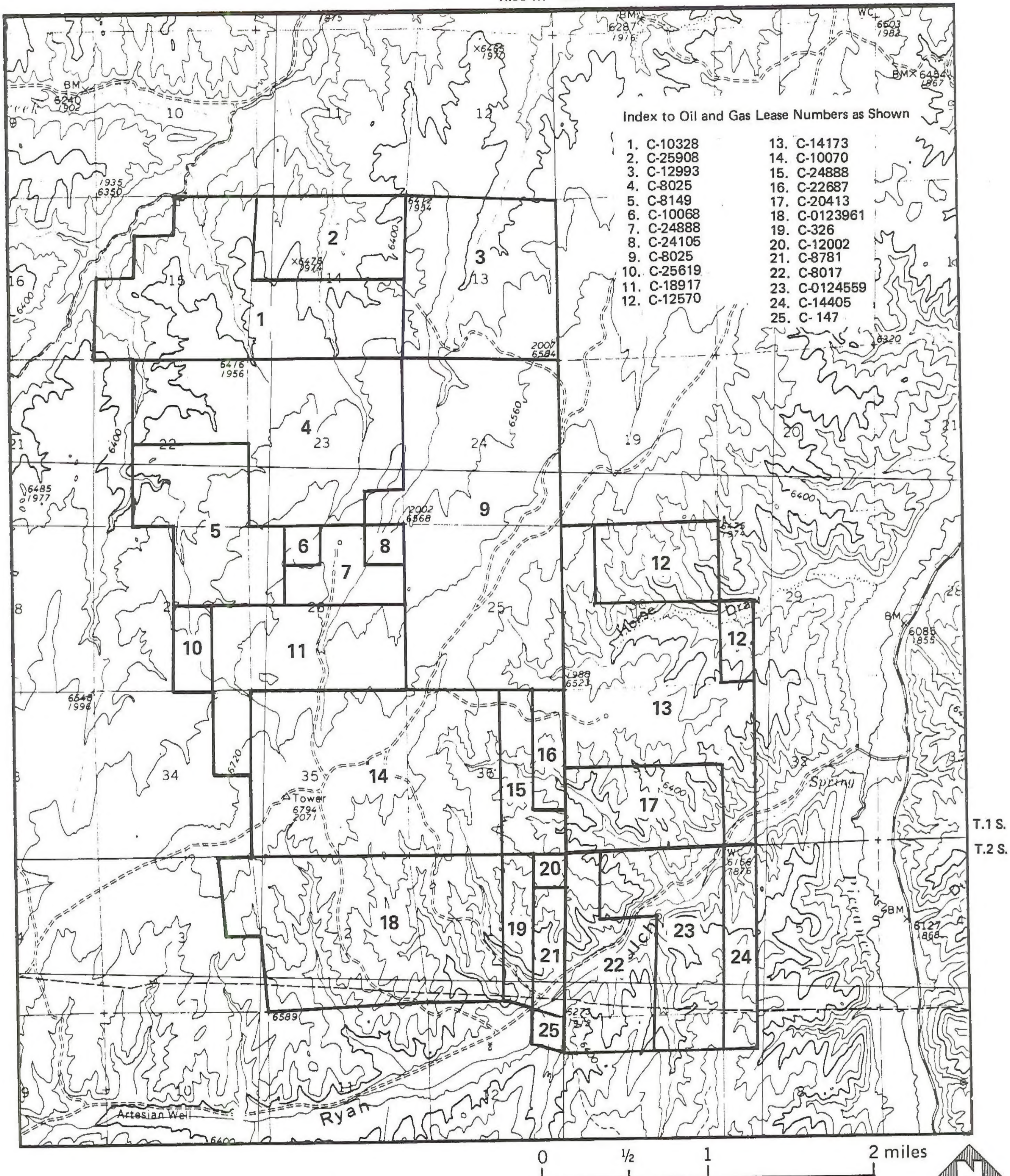



**Figure III-17 Surface Encumbrances, Shows Location of Pipeline, Road and Telephone Rights-Of-Way, and Public Water Reserves on the Tracts**

R.98 W. R.97 W.




Proposed Prototype Oil Shale Lease Tracts

**Figure III-18 Existing Oil and Gas Leases, Shows Location and Lease Numbers on Both Tracts**

# CHAPTER IV

# ENVIRONMENTAL CONSEQUENCES

# CHAPTER IV
# ENVIRONMENTAL CONSEQUENCES

## AIR QUALITY

As outlined in Chapter III, Air Quality, several atmospheric pollutants in the study region are approaching or exceed air quality standards. Any new emission source in the region would compound this situation. In order to determine the contribution of additional prototype developments to these impacts, pollutant concentrations were estimated using the Topographic Air Pollution Analysis System (TAPAS). TAPAS is a system composed of several air quality-related computer models (principally WINDS and CITPUFF). These models predict the resulting ground level concentrations by taking into account topography, ground cover (surface roughness), wind speed and direction, and industrial plant emission characteristics.

TAPAS was employed to determine worst-case pollution concentrations throughout the region, particularly from long range transport over complex terrain into nearby pristine areas. The following steps were neccessary during the analysis:

- Specification of the modeling region to determine boundaries, topography, ground cover, background pollutant concentrations, emission factors, sources and sensitive receptors.

- Various wind field analyses to determine the worst-case meteorologic transport conditions.

- Modeling of pollutant sources concurrently with wind field analyses.

- Scaling and combining various sources under all analysis scenarios to determine predicted ground level pollutant concentrations.

Prior to applying the models, several assumptions/conditions were established. They are:

- Air quality standards violations would be caused first under 24 hour worst-case conditions.

- Only Total Suspended Particulates (TSP), Sulfur dioxide ($SO_2$) and Nitrogen oxides ($NO_x$) criteria pollutants would be emitted in significant amounts.

- A two-minute grid scale (each grid approximately 2.9 by 3.7 km in size) would be large enough to contain the most sensitive areas and still provide adequate resolution of concentration values.

- Scenarios and emission factors used for the Uinta Basin Synfuels EIS and the Programmatic Oil Shale EIS would be incorporated into the prototype analyses. Emissions estimates would be reviewed by appropriate regulatory authority.

- Emission rates for direct mining and surface retorting (DM/SR) and mine assisted in-situ (MAIS) development processes would be proportional to "Union B" and "C-b MIS" emission rates, respectively. Since reliable emissions values for true in-situ development at 25-50,000 bbls/day capacity are not available, this technique could not be modeled. Emissions will be controlled by the Best Available Control Technology (BACT) including: wet/chemical supression, covered conveyors, and baghouse controls of dust; electrostatic precipitation and wet scrubbing of combustion particulates; low $NO_x$ burners; flue gas desulfurization; CO incineration; wetting and compacting spent shale; floating roof and conservation vents on fixed roof fuel storage tanks; and, smokeless vent gas flare designs.

- High production levels, worst-case analysis would be performed first to limit the amount of modeling necessary to screen pollutant impacts.

- Maximum emission levels, including major new sources in addition to federal oil shale development, would be reached by 2003.

- Based on monitoring results and basic modeling techniques (Turner 1969), input parameters would be selected to minimize atmospheric mixing, including: a west-southwest wind at 4 meters per second, an effective plume rise above ground level of 300 meters for elevated sources and 25 meters for low-level sources, Pasquill stability Class E (stable) and a wet adiabatic lapse rate.

- Due to the general, preliminary nature of the anticipated scenarios, specific development details are lacking. Therefore air pollutant impacts must be modeled conservatively (over-emphasizing impacts) and generically. Actual industrial development will require detailed monitoring and modeling to obtain necessary air quality permits (i.e. detailed development NEPA analysis, PSD permit review, Major Fuel Burning Installation approval, Colorado Air Contaminant Emission Notice and Permit, and others).

Results must be evaluated with an understanding of the general limitations of air quality mod-

eling in complex terrain - uncertainties of an order of magnitude could be expected. The analyses performed were designed to provide worst-case estimates rather than average values. Therefore, the worst case assumptions and computer results expressed in this environmental statement should not necessarily be construed as a basis for deciding not to lease. However, high pollutant concentrations do indicate potential air quality problem areas.

Impacts to Air Quality-Related Values (AQRVs) in sensitive areas would be predicted through rudimentary acid deposition calculations and established visibility screening analysis (Latimer and Ireson 1980).

The following discussion summarizes the extensive modeling results. A detailed presentation of the modeling activities is found in Revised Air Quality Impact Assessment for the Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program (Dietrich et al 1982b).

Figure IV-1 shows the region modeled, grid size, topography, new emission sources, and sensitive receptor locations. Table IV-1 describes the location and production rates assumed for sources located in Figure IV-1. Table IV-1a lists their respective emission totals and anticipated emissions from additional prototype development under various scenarios.

Although too little information is available to adequately define regional background pollutant concentrations throughout the study area, a rudimentary estimate of future pollutant levels for specific areas is possible based on extensive work by PEDCO Environmental, Inc. (1982) and Systems Applications, Inc. (1982). As detailed in Dietrich et al. (1982a), primary increases in TSP levels would be due to population growth and mining activities.

Increases in TSP for population centers were estimated by scaling current (1978-82) pollutant levels by increased population projections. Concentration values were only projected in areas with significant current population or industry; rural and wilderness areas were assumed to remain at the 1978-1982 concentration indefinitely. Worst-case background TSP additions due to surface coal mines were calculated using procedures outlined by Turner (1969). It was assumed that the only significant background increases in $SO_2$ and $NO_x$ would result from the major point sources modeled separately with TAPAS. Table IV-1b displays anticipated background TSP concentration levels in 1993 and 2003.

As summarized in Chapter III, Affected Environment and in Table IV-1b, nearly every town in the study area violates the TSP Ambient Air Quality Standard. The significance of TSP violations will change once the EPA implements a fine particulate standard. The most probable pollutants that will increase in towns will be TSP, $NO_x$ and CO, but it is beyond current modeling capabilities to accurately predict regional pollutant levels due to secondary sources 20 years into the future; further efforts will need to be developed to determine impacts from non-major emitting facilities.

Table IV-2 summarizes the maximum 24 hour predicted concentrations for TSP, $SO_2$ and $NO_x$ from new sources in 2003, and the proportion various major emission sources contribute to the maximum. It should be noted that the point of maximum impact from all facilities may not be identical to the point of maximum impact for each individual source.

Even without additional prototype oil shale leasing, air quality impacts are predicted in the PSD Class II areas. Depending on the relationship between the predicted pollutant concentration range and the corresponding standard, the potential for increment consumption is described as high, moderate or low. Although local scale modeling would refine the predictions, TAPAS results indicate a high potential that TSP increments will be exceeded along the Roan Cliffs and the Grand Hogback north of Rifle, Colorado, and east of Bonanza, Utah. It is moderately probable that $SO_2$ increments will also be exceeded along the the Roan Cliffs.

The modeling analysis indicates (with a low potential) that the Colorado Category I $SO_2$ increment will be exceeded within Dinosaur National Monument. There is a moderate potential that Class I TSP and $SO_2$ increments will be exceeded within Flat Tops Wilderness. It may appear (from Table IV-2) that $SO_2$ increments in Mt. Zirkel may also be exceeded, but the sole source of impact is a "non-increment consuming" facility, for which PSD increment considerations do not apply. These impacts are based on 2003 high level emissions without any additional federal leases.

If additional prototype federal lease developments occur at the 2003 high level, regardless of production level or process, no additional exceedance of PSD increments is predicted. Figures IV-2, IV-3 and IV-4 show these anticipated ground level concentrations for TSP, $SO_2$ and $NO_x$, respectively, assuming all sources at highest production.

To assess the contribution of anticipated prototype leasing to the above total concentrations, impacts for these sources were modeled independently for two development techniques at four production levels. Results are summarized in Tables IV-3 and IV-4, and displayed in Figures IV-5, IV-6

TABLE IV-1
PROJECT OPERATION ASSUMPTIONS FOR MODELED POINT SOURCES a/

| SOURCE/PROCESS | ELEVATION | LOCATION LATITUDE | LONGITUDE | PRODUCTION RATE 1993 LOW | 1993 HIGH | 2003 LOW | 2003 HIGH |
|---|---|---|---|---|---|---|---|
| Colorado Synfuel | | | | | | | |
| Cathedral Bluffs/ C-b MIS | 2100m | 39° 48' | 108° 14' | 0 | 21 | 21 | 76 |
| Chevron-Retort/ Staged Turbulent Bed | 2470m | 39° 37' | 108° 25' | 0 | 50 | 50 | 100 |
| -Upgrade | 1550m | 39° 19' | 108° 44' | - | - | - | - |
| Colony/Tosco II | 2440m | 39° 37' | 108° 07' | 48 | 48 | 48 | 48 |
| Mobil/Union B | 2560m | 39° 32' | 108° 05' | 0 | 0 | 0 | 50 |
| Rio Blanco/C-a MIS | 2230m | 39° 53' | 108° 32' | 0 | 50 | 50 | 100 |
| Superior-Pacific/ Superior | 1770m | 39° 32' | 108° 18' | 0 | 0 | 0 | 15 |
| Union/Union B | 2320m | 39° 24' | 108° 05' | 10 | 50 | 50 | 90 |
| C-11/C-b MIS or Union B | 2000m | 39° 55' | 108° 21' | 0 | 25 | 0 | 50 |
| C-18/C-b MIS or Union B | 1980m | 39° 57' | 108° 22' | 25 | 25 | 50 | 50 |
| Colorado Power Plants | | | | | | | |
| Craig/Coal Fired | 1920m | 40° 28' | 107° 35' | 1340 | 1340 | 1340 | 1340 |
| Hayden/Coal Fired | 1980m | 40° 29' | 107° 11' | 465 | 465 | 465 | 465 |
| Utah Synfuel | | | | | | | |
| Enercor-Rainbow/ Steam Extraction | 2130m | 39° 44' | 109° 08' | 5 | 5 | 5 | 5 |
| Paraho-Ute/Paraho | 1650m | 40° 01' | 109° 07' | 10 | 10 | 10 | 42 |
| Syntana/Superior-Tosco II | 1770m | 40° 03' | 109° 05' | 0 | 17 | 17 | 57 |
| Western/Tar Sands | 1800m | 40° 14' | 109° 16' | 5 | 5 | 5 | 5 |
| White River/ Superior-Union B | 1650m | 39° 56' | 109° 11' | 15 | 50 | 50 | 100 |
| Utah Power Plant | | | | | | | |
| Moonlake/Coal Fired | 1520m | 40° 05' | 109° 16' | 800 | 800 | 800 | 800 |
| Synfuel Summary | | | | | | | |
| Colorado Synfuel | | | | 83 | 269 | 269 | 579 |
| Utah Synfuel | | | | 25 | 87 | 87 | 207 |
| Total Synfuel | | | | 108 | 356 | 356 | 786 |

Source: Dietrich et al 1982b
a/ Synfuel production in 1000 barrels per day; power plant production in Megawatts.

TABLE IV-1a

TOTAL EMISSION ASSUMPTIONS FOR MODELED POINT SOURCES (gm/sec) a/

| Source | 1993 Low | | | 1993 High | | | 2003 Low | | | 2003 High | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TSP | $SO_2$ | $NO_x$ | TSP | $SO_2$ | $NO_x$ | TSP | $SO_2$ | $NO_x$ | TSP | $SO_2$ | $NO_x$ |
| Colorado Synfuel | | | | | | | | | | | | |
| Cathedral Bluffs | 0 | 0 | 0 | 19 | 42 | 172 | 19 | 42 | 172 | 67 | 153 | 621 |
| Chevron-retort | 0 | 0 | 0 | 77 | 51 | 516 | 77 | 51 | 516 | 154 | 101 | 1031 |
| -Upgrade | 0 | 0 | 0 | 8 | 22 | 92 | 8 | 22 | 92 | 16 | 44 | 183 |
| Colony | 34 | 40 | 220 | 34 | 40 | 220 | 34 | 40 | 220 | 34 | 40 | 220 |
| Mobil | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 66 | 194 |
| Rio Blanco | 0 | 0 | 0 | 39 | 14 | 117 | 39 | 14 | 117 | 78 | 28 | 233 |
| Superior-Pacific | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 44 | 22 |
| Union | 10 | 13 | 39 | 50 | 66 | 194 | 50 | 66 | 194 | 90 | 120 | 350 |
| C-11 - MAIS | 0 | 0 | 0 | 22 | 50 | 204 | 0 | 0 | 0 | 44 | 101 | 408 |
| C-11 - DM/SR | 0 | 0 | 0 | 25 | 33 | 97 | 0 | 0 | 0 | 50 | 67 | 194 |
| C-18 - MAIS | 22 | 50 | 204 | 22 | 50 | 204 | 44 | 101 | 408 | 44 | 101 | 408 |
| C-18 - DM/SR | 25 | 33 | 97 | 25 | 33 | 97 | 50 | 67 | 194 | 50 | 67 | 194 |
| Colorado Power Plants | | | | | | | | | | | | |
| Craig | 90 | 371 | 742 | 90 | 371 | 742 | 90 | 371 | 742 | 90 | 371 | 742 |
| Hayden | 23 | 348 | 245 | 23 | 348 | 245 | 23 | 348 | 245 | 23 | 348 | 245 |
| Utah Synfuel | | | | | | | | | | | | |
| Enercor-Rainbow | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 3 |
| Paraho-Ute | 0 | 0 | 0 | 6 | 12 | 32 | 6 | 12 | 32 | 27 | 50 | 134 |
| Syntana | 0 | 0 | 0 | 11 | 11 | 62 | 11 | 11 | 62 | 36 | 36 | 206 |
| Western | 6 | 3 | 3 | 6 | 3 | 3 | 6 | 3 | 3 | 6 | 3 | 3 |
| White River | 8 | 6 | 34 | 27 | 19 | 115 | 27 | 19 | 115 | 55 | 38 | 230 |
| Utah Power Plant | | | | | | | | | | | | |
| Moonlake | 31 | 53 | 281 | 31 | 53 | 281 | 31 | 53 | 281 | 31 | 53 | 281 |

Source: Dietrich et al 1982b

a/ Modeled emissions for varying stack heights appear in the supplemental impact analysis technical report (Dietrich et al 1982b).

TABLE IV-1b

EXPECTED "WORST-CASE" BACKGROUND 24-HOUR MAXIMUM TSP CONCENTRATIONS
(micrograms/cubic meter)
HIGH LEVEL PRODUCTION SCENARIO

| Sensitive Areas | 1993 | 2003 |
|---|---|---|
| Class I Areas | | |
| Flat Tops wilderness | 200-280 | 360-480 |
| Mt. Zirkel Wilderness | 90-150 | 90-150 |
| Category I Areas | | |
| Dinosaur Nat'l Mont. | 80-130 | 90-150 |
| Developed Class II Areas | | |
| Craig | 200-300 | 200-350 |
| Glenwood Springs | 150-380 | 150-450 |
| Grand Junction | 110-220 | 160-370 |
| Meeker | 40-120 | 100-270 |
| Rangely | 140-180 | 410-680 |
| Rifle | 190-570 | 210-570 |
| Rural Class II Areas | | |
| Roan Cliffs | 190-310 | 310-510 |
| Grand Hogback | 180-240 | 210-230 |
| East of Bonanza, UT | 200-330 | 220-370 |
| Near Horse Draw | 80-130 | 460-750 |

Source: Dietrich et al 1982b; PEDCO Environmental, Inc. 1982; and Systems Applications, Inc. 1982.

NOTE: Ranges are based on very limited monitored data or interpolated modeled data. Ranges were calculated for meteorologic conditions which are different than the conditions assumed for the point source impact analyses. These values cannot be added to estimate a total impact. Values for areas outside developed towns are highly uncertain, but represent expected worst-case.

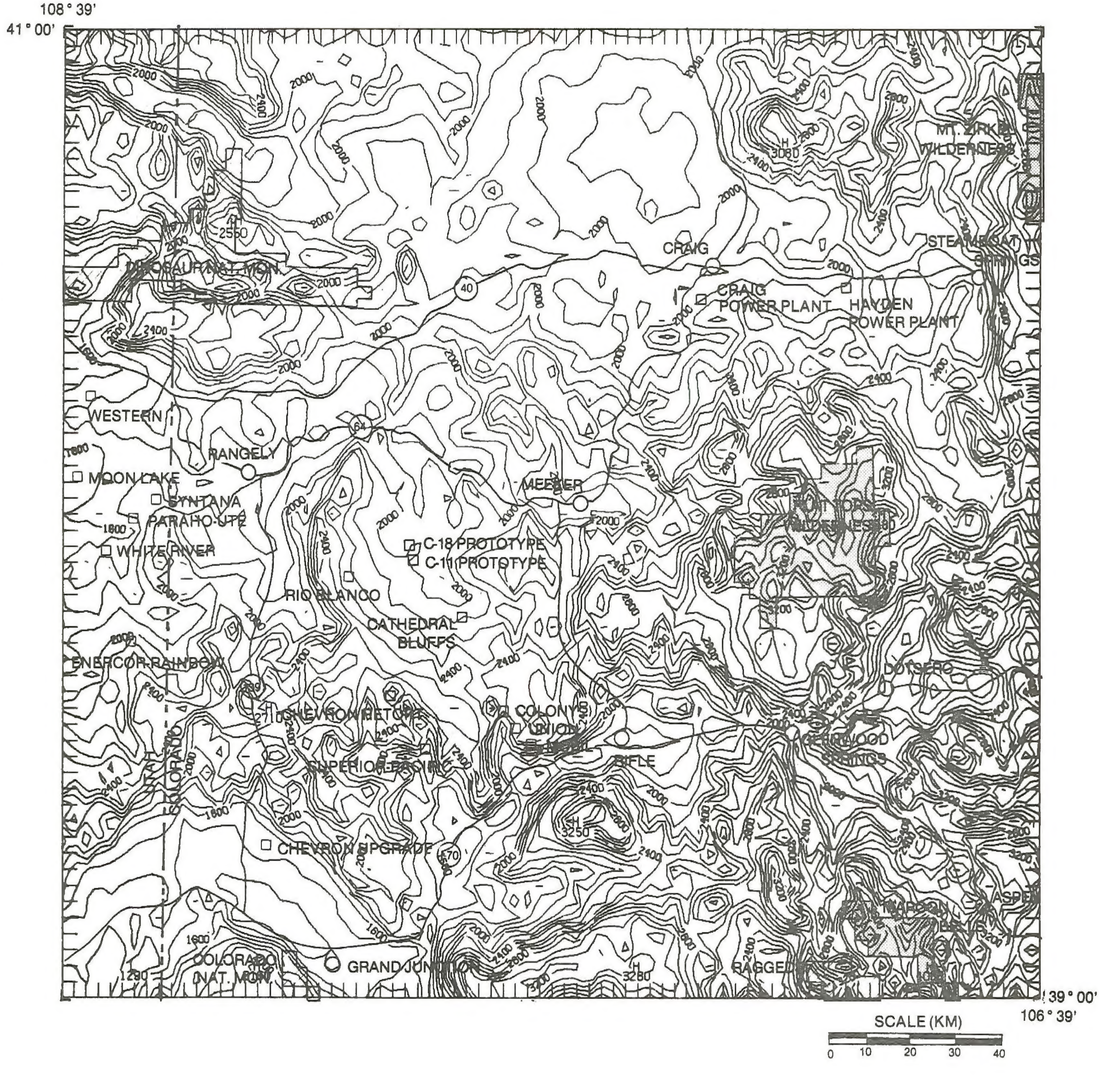



Figure IV-1 Prototype Air Quality Analysis Study Area (Elevation in Meters, 100 m Contour Intervals).

TABLE IV-2
EXPECTED "WORST-CASE" POINT SOURCE 24-HOUR MAXIMUM POLLUTANT CONCENTRATIONS
(micrograms/cubic meter)
2003 HIGH LEVEL MINE ASSISTED IN-SITU SCENARIO

| Sensitive Areas | No Action Alternative TSP | No Action Alternative $SO_2$ | No Action Alternative $NO_x$ | Leasing Alternative TSP | Leasing Alternative $SO_2$ | Leasing Alternative $NO_x$ |
|---|---|---|---|---|---|---|
| Class I Areas | | | | | | |
| Flat Tops Wilderness | 5-13 | 4-10 | 21-51 | 5-13 | 4-10 | 21-51 |
| Chevron-Retort | 20% | 18% | 38% | 20% | 18% | 38% |
| Chevron-Upgrade | 1% | 2% | 1% | 1% | 2% | 1% |
| Union | 39% | 46% | 32% | 39% | 46% | 32% |
| Mobil | 37% | 32% | 26% | 37% | 32% | 26% |
| Colony | 3% | 1% | 3% | 3% | 1% | 3% |
| Superior-Pacific | <1% | 1% | <1% | <1% | 1% | <1% |
| Mt. Zirkel Wilderness | 0-1 | 6-15 | 4-11 | 0-1 | 7-16 | 6-14 |
| Hayden Power Plant | 100% | 100% | 100% | 79% | 95% | 76% |
| Tract C-18 | 0% | 0% | 0% | 18% | 5% | 22% |
| Tract C-11 | 0% | 0% | 0% | 3% | 1% | 2% |
| Category I Areas | | | | | | |
| Dinosaur Nat'l Monument | 2-5 | 2-6 | 12-28 | 2-5 | 2-6 | 12-28 |
| Syntana | 38% | 27% | 37% | 38% | 27% | 37% |
| Moonlake Power Plant | 17% | 25% | 27% | 17% | 25% | 27% |
| Paraho-Ute | 17% | 46% | 20% | 17% | 46% | 20% |
| White River | 23% | <1% | 15% | 23% | <1% | 15% |
| Western | 4% | 2% | 1% | 4% | 2% | 1% |
| Class II Areas | | | | | | |
| Roan Cliffs | 143-343 | 43-104 | 309-742 | 143-343 | 43-104 | 309-742 |
| Union | >99% | 99% | >99% | >99% | 99% | >99% |
| Chevron - Upgrade | <1% | 1% | <1% | <1% | 1% | <1% |
| Grand Hogback | 52-124 | 38-90 | 140-335 | 52-124 | 38-90 | 140-335 |
| Union | 93% | 89% | 91% | 93% | 89% | 91% |
| Colony | 5% | <1% | <1% | 5% | <1% | <1% |
| Mobil | <1% | 8% | 6% | <1% | 8% | 6% |
| Chevron - Upgrade | 1% | 2% | 2% | 1% | 2% | 2% |
| Superior - Pacific | 1% | 1% | <1% | 1% | 1% | <1% |
| East of Bonanza, UT | 63-151 | 3-7 | 180-433 | 63-151 | 3-7 | 180-433 |
| Paraho-Ute | 84% | 91% | 78% | 84% | 91% | 78% |
| White River | 16% | 9% | 22% | 16% | 9% | 22% |
| Near Horse Draw | 0 | 0 | 0 | 12-30 | 5-11 | 20-48 |
| Tract C-18 | - | - | - | 100% | 100% | 100% |

Source: Dietrich et al 1982b (West-Southwest influencing wind of four meters per second, "Class E" stability)

Note: Maximum impact from all facilities in each sensitive area may not be identical to the point of maximum impact for each individual project.

TABLE IV-3

EXPECTED "WORST-CASE" 24-HOUR MAXIMUM POLLUTANT CONCENTRATIONS
(micrograms/cubic meters)
IMPACTS FROM MINE ASSISTED IN-SITU PROTOTYPE DEVELOPMENT ONLY

| | CLASS II MAXIMUM | | | MT. ZIRKEL WILDERNESS | | |
|---|---|---|---|---|---|---|
| Production Scenario | TSP | $SO_2$ | $NO_x$ | TSP | $SO_2$ | $NO_x$ |
| No Action | 0 | 0 | 0 | 0 | 0 | 0 |
| 25,000 bbl/day | 3-7 | 1-3 | 5-12 | 0 | <1 | 0-1 |
| 50,000 bbl/day | 6-15 | 2-6 | 10-24 | <1 | <1 | 1-2 |
| 100,000 bbl/day | 12-30 | 5-11 | 20-48 | <1 | 0-1 | 1-3 |
| PSD Increment | 37 | 91 | -- | 10 | 5 | -- |

Source: Dietrich et al 1982b (West-Southwest influencing wind of four meters per second, "Class E" stability).

TABLE IV-4

EXPECTED "WORST-CASE" 24-HOUR MAXIMUM POLLUTANT CONCENTRATIONS
(micrograms/cubic meters)
IMPACTS FROM DIRECT MINING AND SURFACE RETORTING PROTOTYPE DEVELOPMENT ONLY

| | CLASS II MAXIMUM | | | MT. ZIRKEL WILDERNESS | | |
|---|---|---|---|---|---|---|
| Production Scenario | TSP | $SO_2$ | $NO_x$ | TSP | $SO_2$ | $NO_x$ |
| No Action | 0 | 0 | 0 | 0 | 0 | 0 |
| 25,000 bbl/day | 3-8 | 1-2 | 2-6 | <1 | <1 | <1 |
| 50,000 bbl/day | 7-17 | 2-4 | 5-11 | <1 | <1 | 0-1 |
| 100,000 bbl/day | 14-34 | 3-7 | 9-23 | <1 | 0-1 | 0-1 |
| PSD Increment | 37 | 91 | -- | 10 | 5 | -- |

Source: Dietrich et al 1982b (West-Southwest influencing wind of four meters per second, "Class E" stability).

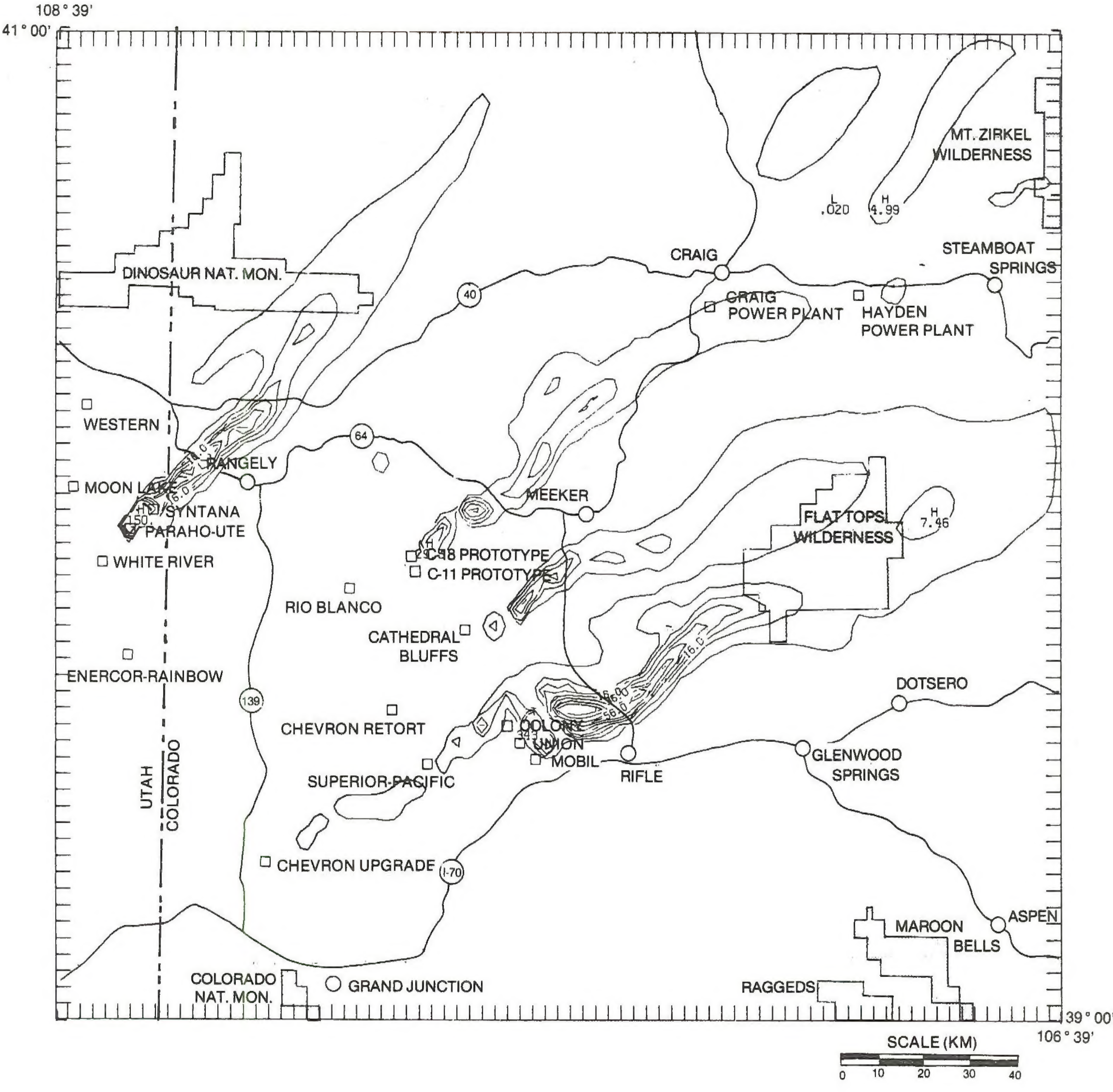



**Figure IV-2 Air Quality Ground Level Concentrations for Mine Assisted In-situ, High Production for TSP, All Point Sources (Micrograms per Cubic Meter; West-southwest Influencing Wind of Four Meters per Second, "Class E" Stability)**

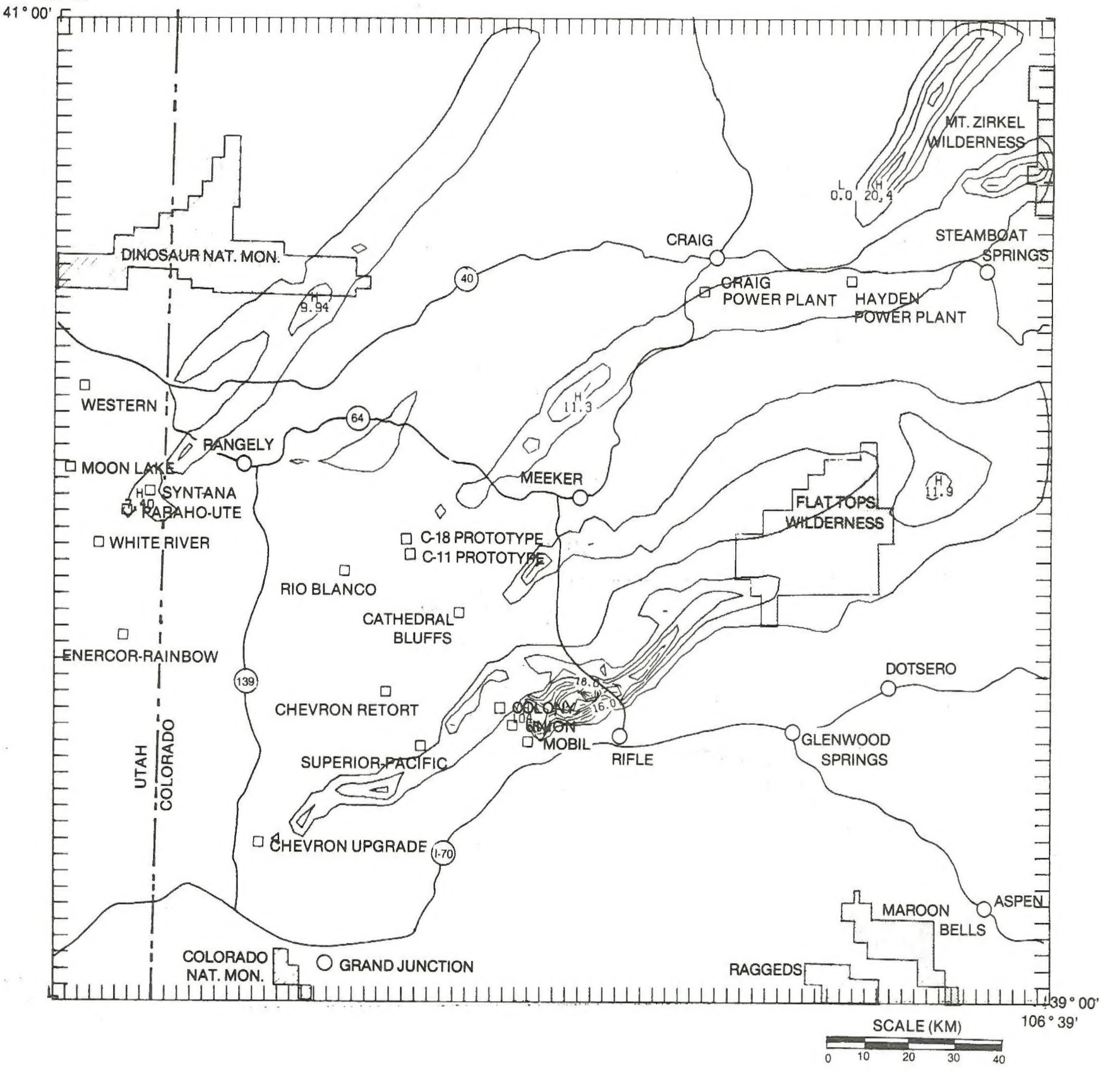



**Figure IV-3** Air Quality Ground Level Concentrations for Mine Assisted In-situ, High Production for $SO_2$, All Point Sources (Micrograms per Cubic Meter; Contours from 1.0 in Increments of 5.0; West-southwest Influencing Wind of Four Meters per Second, "Class E" Stability).

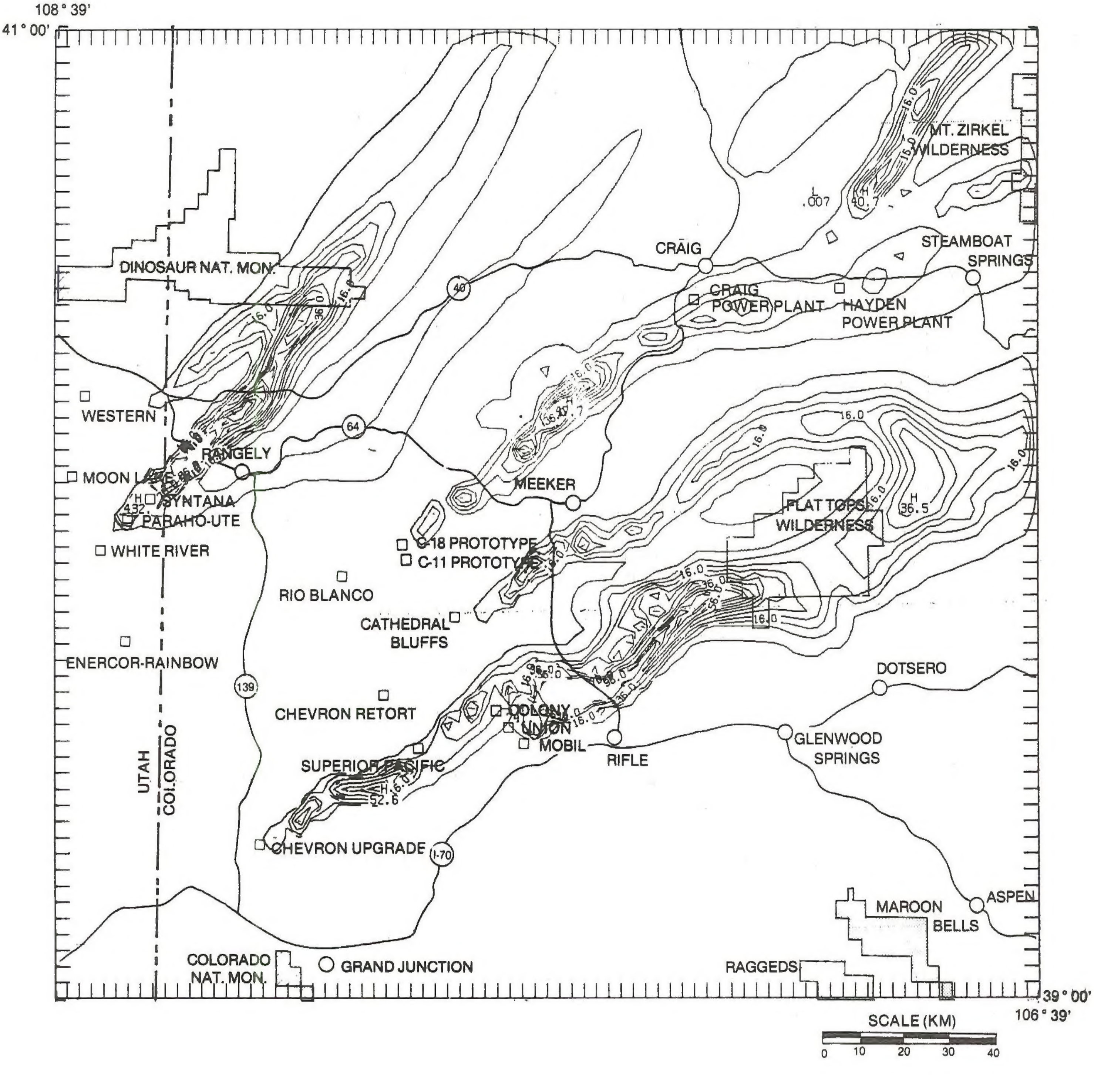



**Figure IV-4 Air Quality Ground Level Concentrations for Mine Assisted In-situ, High Production for $NO_x$, All Point Sources (Micrograms per Cubic Meter; Contours from 1.0 in Increments of 5.0; West-southwest Influencing Wind of Four Meters per Second, "Class E" Stability).**

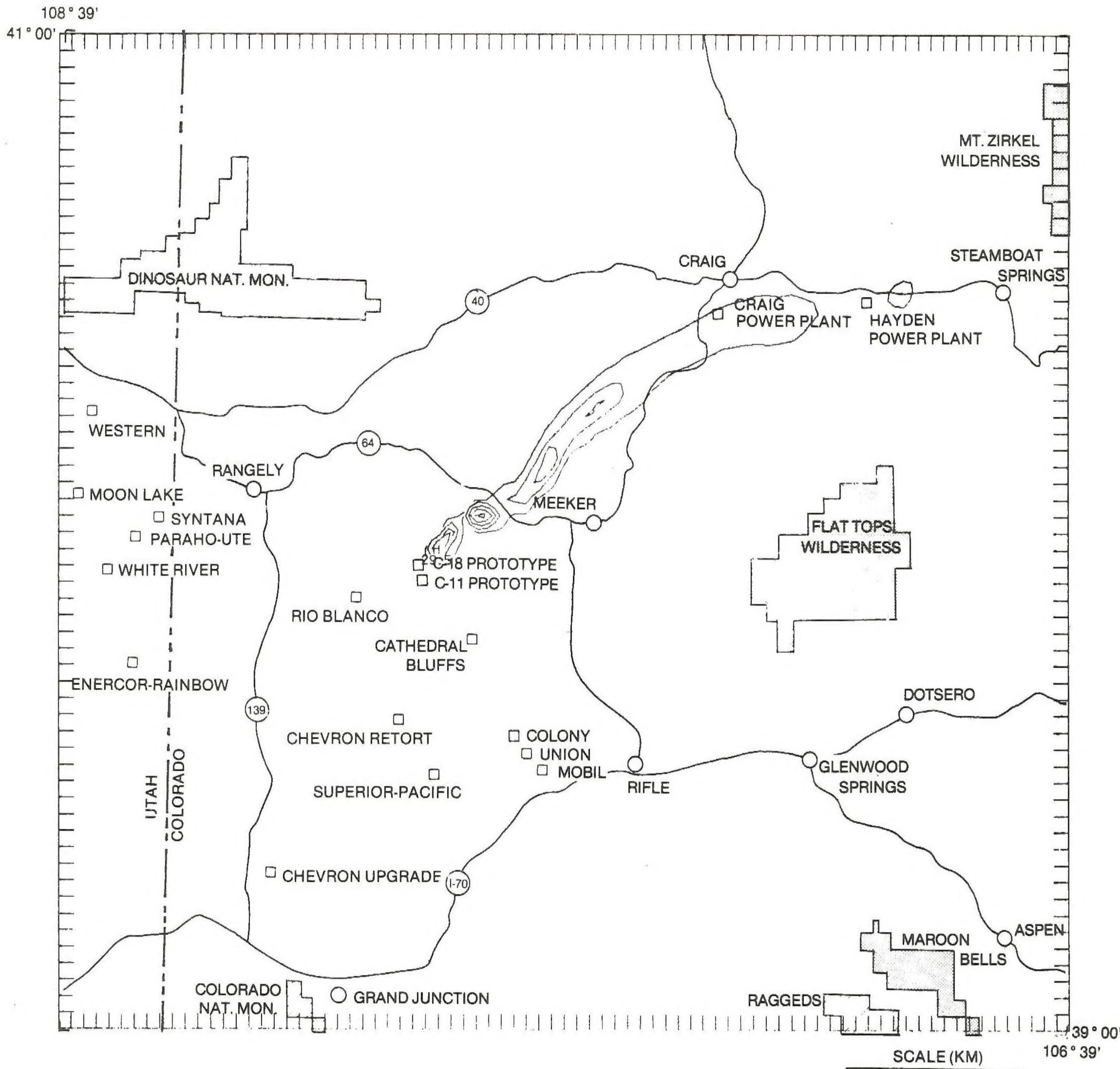



Figure IV-5 Air Quality Ground Level Concentrations for Mine Assisted In-situ, High Production for TSP, Tracts C-11 and C-18 Only (Micrograms per Cubic Meter; Contours from 1.0 in Increments of 5.0; West-southwest Influencing Wind of Four Meters per Second, "Class E" Stability)

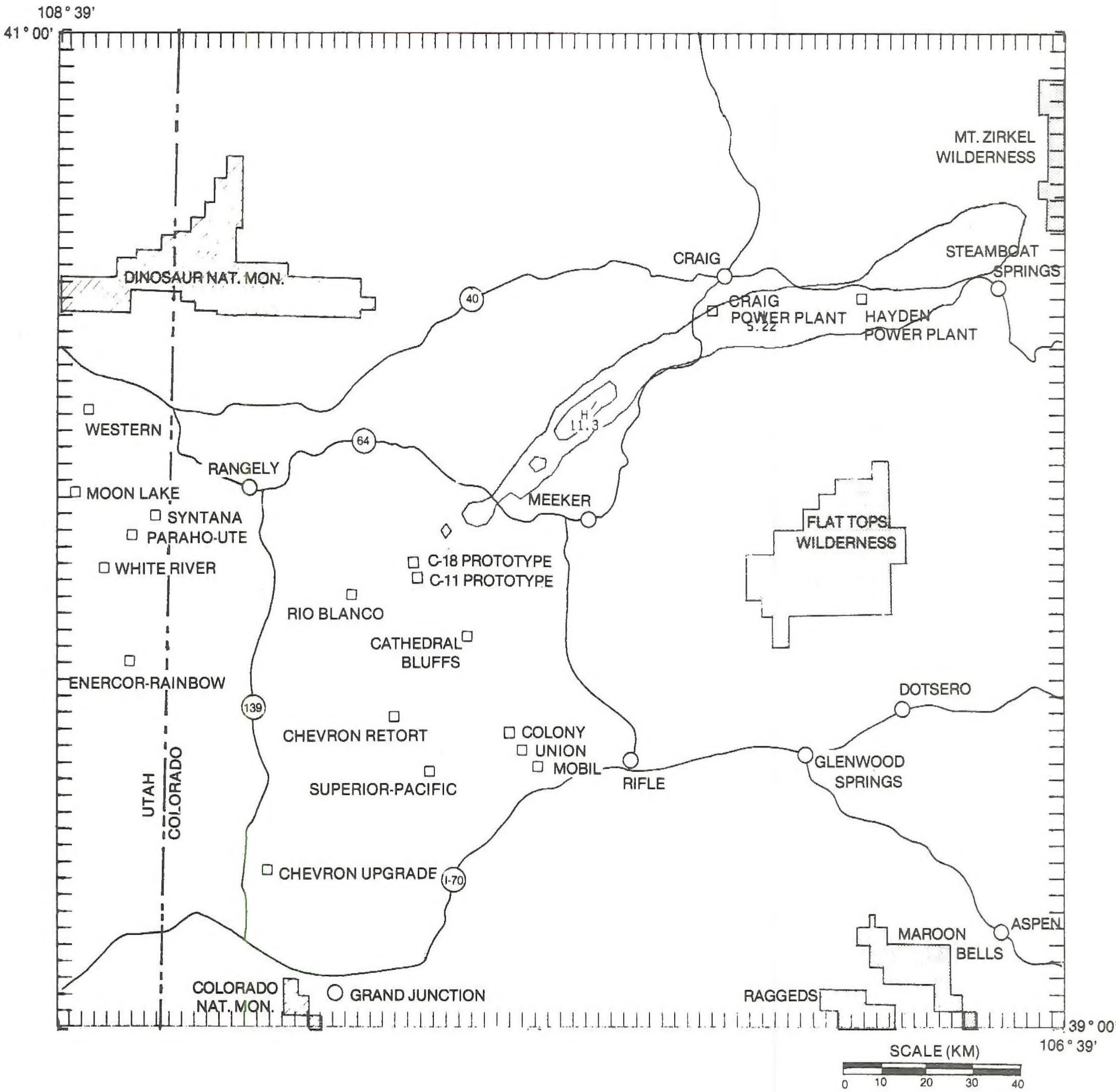



Figure IV-6 Air Quality Ground Level Concentrations for Mine Assisted In-situ High Production for $SO_2$, Tracts C-11 and C-18 Only (Micrograms per Cubic Meter; Contours from 1.0 in Increments of 5.0; West-southwest Influencing Wind of Four Meters per Second, "Class E" Stability)

and IV-7. No exceedance of PSD increment is predicted due solely to additional prototype lease development, but at the 2003 high level, 32 to 92 percent of Class II TSP increment may be consumed.

As recommended by the EPA in their *Workbook for Estimating Visibility Impairment* (Latimer and Ireson 1980), a Level 1 screening analysis was performed to assess visibility impairment from the proposed prototype lease development. Results of the analysis (Dietrich et al 1982b), indicate that development at 50,000 bbl/day or less by either processing technique is highly unlikely to cause significant visibility impairment in the existing or proposed PSD Class I areas in the study region. Further screening analyses beyond the Level 1 evaluation are necessary to assess potential visibility impairment in Dinosaur National Monument (proposed Class I) with development by either process at 100,000 bbl/day and within Flat Tops Wilderness (existing Class I area) with the mine assisted in-situ technology at 100,000 bbl/day. In this case, the likelihood of visibility impairment could best be reduced by lowering $NO_x$ and TSP emissions. Since detailed development data is unavailable, Level 2 and Level 3 analyses could not be performed. Further analyses will be required during the PSD permit review process.

Impacts to other AQRV's in PSD Class I areas are also a concern as air contaminant levels increase; particularly sulfur and nitrogen-related compounds. However, current knowledge of pollutant transport and chemical transformation is limited, and the general processes affecting AQRV's are not well understood. A rudimentary assessment of worst-case 24 hour deposition in the study area was performed by Dietrich et al (1982b) assuming that elemental sulfur and nitrogen deposits are solely formed from $SO_2$ and $NO_x$, respectively. It must be emphasized that deposition values were calculated from worst-case concentrations at a single point; concentration values drop rapidly at surrounding points (each grid point represents nearly 11 km²; the Flat Tops Wilderness Area is nearly 950 km² in size). Ranges were calculated based on the point of maximum predicted pollutant concentration within Flat Tops Wilderness due to additional prototype development only and due to all modeled point sources (Combined Alternative).

High elevation terrain in the west is particularly susceptible to acid deposition due to large amounts of orographically induced precipitation and the generally unreactive geologic structure. A survey of lakes in the Flat Tops Wilderness has been conducted by the U.S. Geological Survey (Turk 1982) to identify existing geologic and hydrologic conditions. Potential shifts in lake acidity were calculated based on this survey for two locations: Ned Wilson Lake (poorly buffered, pH - 7.2) and Lower Marvine Lake (well buffered, pH - 8.3).

Based on rudimentary calculations under the highest production scenario, "worst-case" single point sulfur and nitrogen deposition rates would range from 0.5 to 1.4 and 1.2 to 3.9 kilograms per hectare-year, respectively. These deposition rates are not anticipated to effect the pH of Lower Marvine Lake but could lower Ned Wilson Lake to a pH between 7 and 6. What effect a pH change of this magnitude might have on the biota is unknown, but it must be emphasized that these values are very premliminary and "worst-case". A similar survey of Mt. Zirkel Wilderness has not been performed, but that area may be more sensitive to acid deposition than Flat Tops Wilderness due to higher precipitation and typically less reactive bedrock.

In summary, pollutant emissions from direct development of additional prototype leases and induced, secondary sources will have an "unavoidable, adverse impact" on air quality, but since all predicted impacts are less than the applicable PSD increments, these impacts would be minimal. Substantial impacts to air quality would be caused by other private industrial sources in the region. Stipulations in new oil shale leases will assist in minimizing impacts by requiring: compliance with all applicable air quality statutes, regulations and standards; a baseline and continuing on-site air quality/meteorology monitoring program; an approved air quality control program; and specifically requiring "sprinkling, oiling, or other means of dust control" on roads and generally "make every reasonable effort to avoid ... dust problems" (Environmental Stipulations of the lease, Section 8).

After 2013, (for modeling purposes) when the developed area will be stabilized and decommissioned, no direct impacts to air quality will remain, but irreversible and irretrievable damage could occur because of established urbanization in the region. Additionally, short-term impacts to air quality may be alleviated by natural cleansing processes, but cumulative impacts to human health and vegetation could remain after mine abandonment. Uncommmited mitigation of these impacts could include additional control of emissions from existing sources, increased study of pollutant impacts to AQRVs, and additional background monitoring to better assess regional impacts.

## CLIMATE

In the area immediately surrounding a shale oil development, local wind patterns may be affected

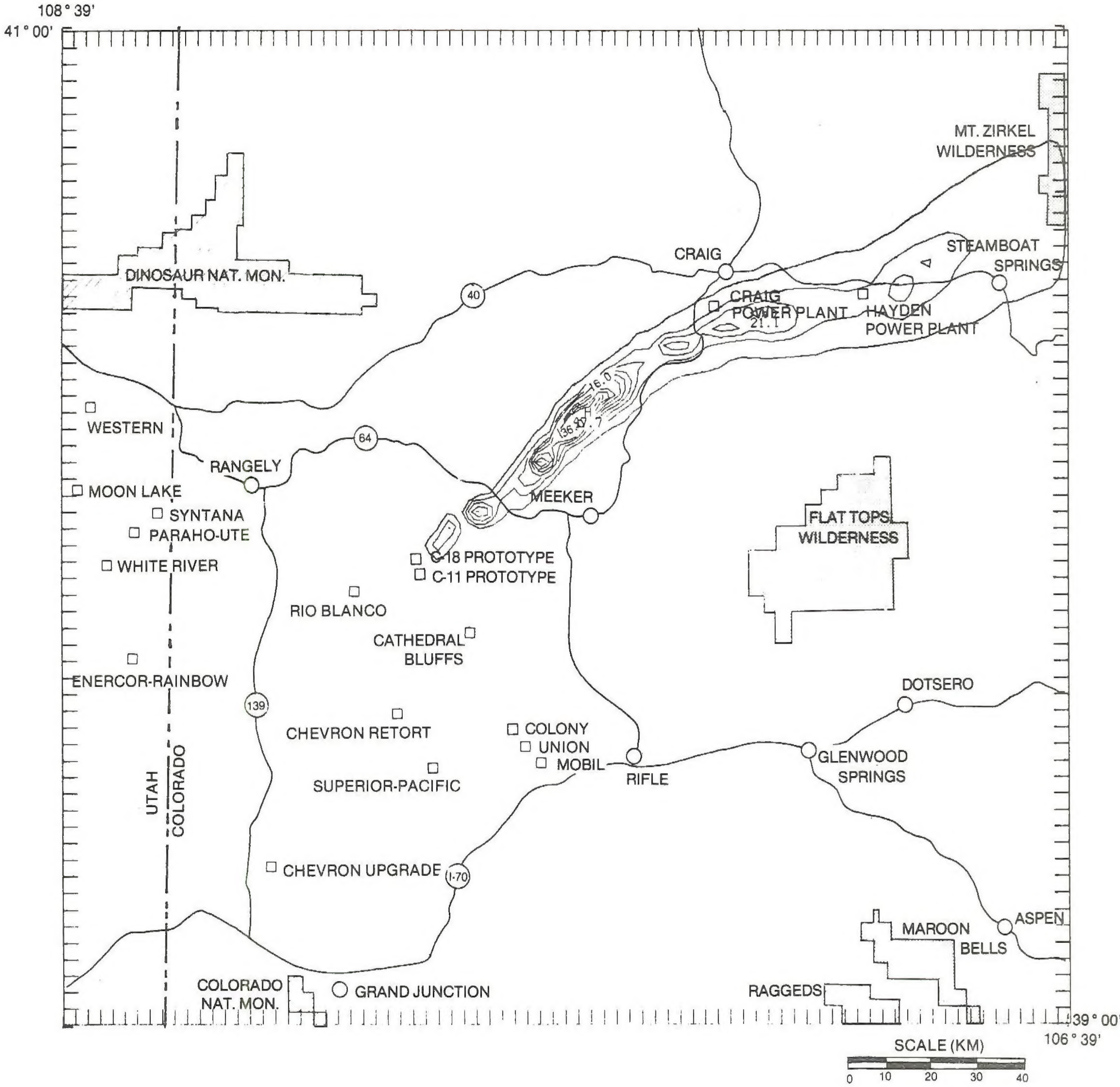



Figure IV-7 Air Quality Ground Level Concentrations for Mine Assisted In-situ, High Production for $NO_x$, Tracts C-11 and C-18 Only (Micrograms per Cubic Meter; Contours from 1.0 in Increments of 5.0; Influencing Wind of Four Meters per Second, "Class E" Stability).

by alteration of the topography or building construction. Land clearing could alter the reflection and evapotranspiration of the ground resulting in temperature and humidity changes. Industrial cooling towers would also affect humidity and could increase the occurrence of ground fog. All of these potential impacts would be very localized and most would be mitigated through vegetative reclamation and the eventual decommissioning of the industrial facility.

Industrial combustion sources all produce fine particulates and carbon dioxide which may lead to global temperature changes (Council on Environmental Quality 1981), but development of additional prototype lease tracts would contribute insignificantly on this scale. No significant impacts to regional climate are anticipated due to any of the proposed lease action alternatives.

# GEOLOGY AND MINERAL ACTIVITY

## No Action Alternative

With the exception of current oil and gas exploration and possible development of the existing sodium Preference Right Lease Applications, no additional impacts on the mineral resources of the two tracts would occur under the No Action Alternative. Current oil and gas exploration and field development programs could proceed on schedule without interference from oil shale development. Construction of the proposed LaSal pipeline, designed to cross through Tracts C-11 and C-18, could proceed unimpeded if rescheduled.

The mineral resource beneath the lease tracts would remain intact except for portions of Tract C-18 that might be developed under existing sodium leases. Assuming that advances and breakthroughs in mining and retorting technologies might occur as the result of development at existing private and Federal oil shale sites, future production of oil shale and associated minerals from these tracts could possibly win a larger percentage of the in place resource if leased at a later date.

The approved mine plan prepared by Multi Minerals Corporation for the sodium lease on Tract C-18 calls for mining from several zones an average 6.5 foot thick zone of nahcolite and oil shale from the saline zone. Oil shale recovered from the room-and-pillar operation will be stockpiled on the surface until sufficient areas have been mined to allow backfill and underground storage (approximately 5 years).

Underground storage in mined-out rooms will protect the oil shale from weathering and deterioration but would require a variance from the Mine Safety and Health Administration (MSHA) for backstowing with a combustable material. Backfilling will also help prevent subsidence, thereby protecting overlying oil shale resources.

Projected mining rates will produce 1,670,000 tons of nahcolite ore per year. Approximately 400,000 tons/year of low-grade (oil shale) material will be stored and ultimately backfilled in the mine. This would result in a projected permanent loss of 270,000 tons/year of low-grade ore. Over a 50 year mine life, a total of 13.5 million tons of oil shale will be lost which is less than 0.3 percent of the estimated recoverable shale oil on the lease tract.

Three additional Sodium Preference Right Lease Applications (PRLAs) are being evaluated by the Bureau (Chapter II, Section B). If the leases are issued then subsequent mine development is expected to proceed under this alternative.

## Development Alternatives

Leasing Tracts C-11 and C-18 will impact the mineral resources on 9,964.71 acres. Only a small percentage of in place resources are recoverable by present technologies. Approximately 20 percent of the total oil shale resource, 14 percent of the in place nahcolite and 13 percent of the estimated dawsonite can feasibly be recovered. Using the most advanced mining, milling and retorting processes currently available will result in an approximate permanent loss of at least 80 percent of the estimated resource as unmined intervals, pillars, and process inefficiencies (see Table IV-5, Estimated Impact on Resource Base of Tracts C-11 and C-18). With nominal improvements in extractive technology, the amount of resource recovery would improve significantly.

The development of oil shale and sodium mining operations on Tracts C-11 and C-18 will not impact any other mineral resource except oil and gas. Possible deep coal deposits that lie beneath the Green River Formation are remote in the likelihood of being mined.

Current lease stipulations require that oil and gas drilling not interfere with mining and recovery of oil shale deposits or result in undue waste of the oil shale resource. Wells must be cased, plugged and abandoned if it is determined that they will interfere with orderly oil shale development.

Drilling cost increases may occur due to casing requirements to develop oil and gas areas previ-

ously mined for oil shale. Minerals Management Service policy states that while oil and gas reserves may be developed simultaneously with the oil shale industry, drilling should not unduly interfere with solid mineral extraction. The currently proposed lease stipulations protecting oil shale lands should be enforced in areas of immediate development of oil shale while, at the same time, allowing continued drilling operations.

These stipulations amount to complete subordination of oil and gas drilling to oil shale development on new leases. Current MMS practices will allow oil and gas drilling on oil shale lands subject to the protection stipulations.

The development of underground mining does not necessarily preclude oil and gas drilling. Depending on well density, mining may progress leaving pillars around each well to protect its integrity. Assuming a pillar with a radius of 100 feet is left surrounding each well, 0.72 acre of oil shale land would be lost per well. Estimated recoverable shale oil is 234,000 to 410,000 bbls/acre. Each well permitted on the lease tracts could conceivably delay or prevent the extraction of up to 295,000 bbls/acre or 72 percent of the recoverable oil shale on the area surrounding the well. However, mining across the breadth of an approximately 8 square mile oil shale tract may take decades. This allows time for oil and gas development to take place on the further reaches of each tract prior to conflicting with shale oil and sodium mineral production.

### Recovery

**Direct Mining** -- The oil shale interval is approximately 1,600 feet thick on the lease tracts including the Mahogany and Saline Zone shales. Of this, approximately 40 percent may be economically mineable. Assuming a maximum recovery of 20 percent of the mineable oil shale, the net recovery of the in place resource is only 8 percent. This assumes that all beds greater than 25 feet thick and averaging 30 gal/ton are mined. Overall resource recovery might increase to 24 percent if it were found to be economically feasible to mine beds as thin as 10 feet in thickness.

Direct mining with surface retorting would allow mining to progress downward on multiple mine levels through the saline zone and within the Mahogany Zone.

**Mine Assisted In-Situ** -- Mine assisted in-situ development has the potential to produce shale oil in commercial quantities by utilizing wider intervals of oil shale than can be directly mined and surface retorted. Resource recovery may be somewhat improved over direct underground mining because a longer interval of resource can usually be processed. Up to 75 percent of the oil shale resource in a mining block (defined as that shale either directly mined or processed in-situ) can be expected to be recovered.

**True In-Situ** -- Low oil recoveries are currently associated with true in-situ processing due to the large unretorted blocks of shale left in the fractured formation or loss of shale to formation overbreakage. Irregular fracturing patterns can cause the heat carrier to by-pass or channel around sections of the deposit. Oil shale that is located in the by-pass areas will not be retorted. Another problem is that some of the oil does not reach the production wells, but remains trapped in the pores of the spent shale or diffuses beyond the production wells, to be lost in the surrounding strata.

### Extraction of Minerals in the Saline Zone

Tests performed at the Bureau of Mines facility at Horse Draw indicate that microcrystalline nahcolite was found to have a compressive strength of 15,000 pounds per square inch (psi) as compared to 12,000 psi for oil shale. These rock strengths indicate good potential for room-and-pillar mining with large room widths. Using room-and-pillar mining in the saline zone, Multi Mineral Corporation (1981) predicts 40 percent resource recovery from the Love Bed (up to 12 feet thick). Large pillars must be left in place to prevent mine subsidence and protect overlying aquifers and oil shale zones.

Mine assisted in-situ mining and processing will extract approximately 10 to 15 percent or more of the in place resource than will direct mining and surface retorting.

True in-situ processing may be technologically feasible for the saline zone. In the saline zone, the soluble minerals would be dissolved, pumped to the surface and recrystallized. Oil shale would subsequently undergo thermal decomposition to liberate kerogen.

True in-situ recovery of soluble sulfur, sodium chloride and other saline minerals, and uranium has been proven technically and economically feasible at many locations throughout the country. Recoveries are generally good, up to 75 percent for homogenous bedded saline deposits, but are poor (less than 20 percent) for zones that must depend on natural or induced fractures for solution circulation.

### Extraction of Minerals From the Leached Zone

True in-situ recovery of shale oil from deep deposits (overburden greater than 500 feet) has had limited testing. Resource recovery from shallow de-

posits as that of the Geokinetics method has generally been very poor when compared to recoveries obtained by direct mining with surface retorting. The leached zone (a deep deposit), due to its natural permeability, would be amenable to some method of true in-situ processing that can take advantage of the natural permeability. The permeability is due in part to the unstable formation conditions that exist which may exclude direct mining and mine assisted in-situ methods.

### Combination of Mining Techniques for Different Zones

Of present, the most apparent application of available technologies for recovery of resource beneath either Tract C-11 or C-18 would be as follows:

- The upper two-thirds of the generally competent strata within the Mahogany Zone could be produced using either direct mining, such as underground room-and-pillar, or mine assisted in-situ. Using the room-and-pillar method, one and possibly two 40 to 60 foot thick mine levels could be mined recovering up to 50 to 60 percent of the oil shale within the mine levels for a 20 percent overall interval recovery. Mine assisted in-situ could also be used developing virtually the entire thickness of the upper Mahogany Zone through three direct mining levels and in place retorting of the shale between the mine levels. This approach might improve overall recovery to possibly 75 percent of the shale within the area of each rubblized chamber for a 30 percent overall interval recovery.

- The leached zone would generally not be amenable to direct mining or mine assisted in-situ because of poor broken ground conditions. It might however, be developed by true in-situ processing whereby super heated steam from a pattern of wells, is circulated through the permeable ground caused by solution cavities and brecciation subsequent to natural groundwater dissolution of saline minerals. Currently, the efficiencies of the technique are extremely poor.

- The saline zone could be directly mined, produced by some adapted form of modified in-situ, or true in-situ. Due to the problems of maintaining accurate borehole alignment, critical to the latter method, borehole length would have to be limited probably necessitating drilling from overlying mine workings. Overall efficiencies of resource recovery would be at the lower limit of those estimated for production from the Mahogany Zone.

### Gassy Mine Conditions

The Bureau of Mines encountered gassy mine conditions at its experimental facility in Horse Draw. Methane release rates (averaged over 10 minutes after blasting), were measured to be 50 cubic feet per ton of material blasted. Health and safety precautions must be provided for workers involved in the mining of oil shale and nahcolite. Current health and safety practices, such as adequate ventilation to disperse explosive and noxious gases, developed by the hard rock and coal industries would be utilized in oil shale production. Proper mine design and ventilation systems must be developed to ensure adequate support to work areas.

### Future Technology Development

Research in resource recovery by true in-situ or various combinations of direct mining (stoping and caving techniques) and mine assisted in-situ technologies is continuing at several locations in the Piceance Basin and around the world. Major breakthroughs that will produce higher recoveries at low unit costs appear unlikely in the near future. Mine assisted in-situ, as developed at Occidental's Logan Wash facility, is presently the state-of-the-art in underground processing. Postponing issuance of the subject leases for the short-term (5-10 years) in hopes of a major breakthrough in technology is not warranted. Research and development of mine assisted in-situ technology on the lease tracts in conjunction with direct mining may provide the new mining technology the industry currently needs.

### Resources Lost Due To Mining Using Current Technology

An estimated 1 to 2 billion barrels of shale oil may be recoverable from beds at least ten feet thick and averaging 30 gallons per ton on both lease tracts. This is approximately 20 percent of the estimated in place resource of 10 billion barrels per tract.

The recovery of 20 percent of the total resource is based upon a conservative extraction-retorting technology using currently available room-and-pillar and surface retorting technology. Employing mine assisted in-situ or true in-situ methods alone as well as in combination would result in recoveries possibly as much as 10 percent more than with direct mining alone (see Table IV-5).

These lease tracts contain the thickest sequences of nahcolite/dawsonite bearing oil shale zones in the Piceance Basin. Important oil and gas resources are also located in the area. Untried and

unproven mining and processing technologies have the potential of wasting vast quantities of valuable mineral resources. Provisions for concurrent oil and gas development should be included in lease stipulations as well as the requirement for attempted full recovery from both the saline zone (nahcolite/dawsonite/oil shale) and leached zone (R-6, Mahogany).

### Impacts of Using Different Technologies on Each Lease Tract

Direct mining by room-and-pillar methods would not cause a significant impact on adjacent lease tracts. Mining (by lease stipulation) may not progress within 100 feet of the lease boundary. Assuming that subsidence is controlled by leaving large pillars and backfilling, there would be no loss of resources outside the mined area. Mine assisted in-situ processing with backfilling as required, results in little or no subsidence. Impacts on offsite mineral resources would not occur. These two mining methods could be used without interference or impact on adjacent lease tracts or on the same lease tract. It also appears possible to use these methods either before or following drilling for oil and gas.

True in-situ processing of minerals in the leached zone could be used taking advantage of naturally created permeability, but would require significant improvement in recovery efficiencies to be economically feasible. True in-situ mining of the saline zone would require extensive fracturing or pre-dissolution of soluble minerals to establish necessary formation permeability and could impact offsite resources if subsidence could not be controlled.

### Subsidence

Due to the mining depths of shale and nahcolite, subsidence is not expected to manifest itself on the surface as caused by either abandoned mine workings (assuming no backfilling of spent shale) or by mine dewatering. Although subsidence may take hundreds of years before its effects reach the surface, block fracturing of the sandstone strata and the resultant bridging of unconsolidated debris will fill the mine workings. Mine dewatering that has been conducted on C-a Tract has shown no effects of subsidence (at shallow mine working depths) caused by the dewatering. When considering backfilling of spent shale material into the mine, the potential of subsidence is even less. Location of surface spent shale disposal sites, retention dams, etc. will be reinforced by thicker support pillars underground in the mine workings. Whether spent shale disposal occurs either on or off tract (pending legislation) disposal sites would have to consider thicker pillars for support.

The amount of subsidence anticilpated to occur will vary by development scenario. In addition, the potential for subsidence will increase as mining recovers more of the mineable oil shale ore. Conventional room and pillar mining (on three levels with 60 foot rooms and 60 foot barrier and sill pillars) and conventional mine assisted in-situ mining (40 percent of the shale is left behind as barrier pillars) would be expected to cause little or no subsidence. When barrier and sill pillars are collapsed and retorted in-situ in conventional room and pillar mining, partial subsidence would be expected to occur. When the entire deposit is mined and all material is retorted above ground (including collapsed barrier and sill pillars) for both conventional room and pillar and mine assisted in-situ scenarios, then full subsidence would be expected to occur.

### Surface Mine Impacts

Surface mining is economically attractive for large, low-grade or shallow buried deposits because it permits high resource recovery using large, efficient mining equipment. An open pit mine could recover up to 50 to 70 percent of the oil shale in a very thick deposit beneath less than 800 feet of overburden.

Open pit mining was originally planned for Tract C-a. The pit was to have started in the northwest corner of the lease and eventually cover the entire surface. Solid wastes would have had to be initially stored offsite in permanent disposal sites. Off-tract disposal is currently not allowed by the Department of Interior. As a result, the lessee has conducted a program to demonstrate mine assisted in-situ techology for development of the resource. Should offsite disposal be allowed, the lessee would return to open pit development of the tract as open pit mining would enable recovery of better than 5 billion barrels of shale compared to only 1.7 to 2.5 billion barrels from mine assisted processing and surface retorting of the shale.

On the proposed lease tracts, overburden is from 900 to 1,200 feet thick. This overburden thickness would preclude surface mining despite the apparently favorable stripping ratio. While removing 1,000 feet of overburden to recover 2,000 feet of shale might be possible in theory, the pit's boundaries would be so extensive that it would have to be located on a much larger tract. Furthermore, the large "front-end" investment required to removing overburden years in advance of retorting would probably make open pit mining on these tracts uneconomical. Proposed plans for a "migrating" open

TABLE IV-5
ESTIMATED IMPACT ON RESOURCE BASE OF TRACTS C-11 and C-18 (in billions)

| Lease Tract | Mined Resource | Estimated in-place Resource | Estimated Recoverable Resource by Mining Method: Direct (1) | Mine Assisted In-Situ (2) | True In-Situ (2) |
|---|---|---|---|---|---|
| C-11 | Shale Oil | 9.2 barrels | 2.6 barrels | 1.6 barrels | .6 barrels |
| | Nahcolite | 3.8 tons | .614 tons | .350 tons | .130 tons |
| | Dawsonite | .920 tons | .155 tons | .113 tons | .0425 tons |
| C-18 | Shale Oil | 10.2 barrels | 2.3 barrels | 1.1 barrels | .413 barrels |
| | Nahcolite | 4.1 tons | .564 tons | .208 tons | .078 tons |
| | Dawsonite | 1.0 tons | .172 tons | .0827 tons | .031 tons |

(1) Estimated recoverable resource data provided by MMS based on room-and-pillar mining with above ground retorting.

(2) Estimated recovery of the resource recoverable by mine assisted in-situ and true in-situ methods cannot be substantiated at this time. However these figures have been estimated with the best available data.

TABLE IV-6
CONVERSION OF CROPLANDS TO OTHER USES 1/
PROJECTED FOR 1993 OR FULL PRODUCTION YEAR 2/ 3/

| Alternative | County | Low Acres | Low % of Total | High Acres | High % of Total |
|---|---|---|---|---|---|
| No Action | Rio Blanco | 710 | 1.0 | 1,070 | 1.6 |
| | Garfield | 3,360 | 3.4 | 4,950 | 5.0 |
| | Mesa: Grand Jct Area | 2,700 | 3.2 | 4,140 | 4.9 |
| Total | | 6,770 | 2.7 | 10,160 | 4.0 |
| C-11 | Rio Blanco | 310 | 0.4 | 400 | 0.6 |
| | Garfield | 510 | 0.5 | 640 | 0.6 |
| | Mesa: Grand Jct Area | 90 | 0.1 | 110 | 0.1 |
| Total | | 910 | 0.3 | 1,150 | 0.5 |
| C-18 | Rio Blanco | 310 | 0.4 | 400 | 0.6 |
| | Garfield | 510 | 0.5 | 640 | 0.6 |
| | Mesa: Grand Jct Area | 90 | 0.1 | 110 | 0.1 |
| Total | | 910 | 0.3 | 1,150 | 0.5 |
| Combined | Rio Blanco | 620 | 0.9 | 790 | 1.1 |
| | Garfield | 990 | 1.0 | 1,280 | 1.3 |
| | Mesa: Grand Jct Area | 200 | 0.2 | 220 | 0.3 |
| Total | | 1,810 | 0.7 | 2,290 | 0.9 |

1/ Based on 0.22 acres converted per person increase in population (Dill and Otte, 1971).

2/ Percentages based on worst case situation assuming all urban expansion occurs on cropland.

3/ Cropland losses for C-11, C-18, and Combined Alternatives are in addition to the No Action Alternative estimates.

pit to move through that portion of the Piceance Basin where the overburden is shallow enough to economically recover oil shale, may not affect the lease tracts.

## FLOODPLAINS

Executive Order 11988 requires agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct or indirect support of floodplain development whenever there is a practical alternative. If an action must be located on a 100 year floodplain, the order requires minimization of potential harm to people and property and to the natural and beneficial floodplain values. For the purpose of this action, development within the floodplains should be avoided wherever possible, and if unavoidable, impacts must be minimized as stated above. Floodplains associated with the lease tracts are described in Chapter III, Floodplains.

## ALLUVIAL VALLEYS

Alluvial valleys may be affected in three ways: 1) groundwater system disruption of water quantity and quality caused by mine development and subsurface retorts, 2) surface disturbing activities such as spent shale disposal placement and topsoil borrow areas for reclamation, and 3) increased sedimentation or erosion. Effects of any mine development and retort scenario upon groundwater contribution to the quality and quantity of water in alluvial valleys is explained in more detail under Chapter IV, Hydrology. Surface disturbances caused to the alluvial valley will be more extensive under the direct mining and surface retort and the mine assisted in-situ methods than the true in-situ method. This is due to the surface disposal and topsoil requirements necessary for spent shale wastes, especially if shale is deposited in valley bottoms.

### No Action Alternative

Development of the C-a Tract may impact water availability to the alluvial valley associated with Yellow Creek. No other impacts to alluvial valleys in or adjacent to the tracts are anticipated at this time.

### C-11 Alternative

Development of the C-11 Tract could materially damage quality and quantity of water supplied to the alluvial valley of Ryan Gulch and Horse Draw. These valleys are tributary to the Piceance Creek alluvial valley and therefore the quantity and quality of water supplied to the Piceance Creek alluvial valley could also be materially damaged.

Direct damage to alluvial valleys such as disposal or burial of spent shale in the alluvial valley, or displacement of the alluvium, could be significant and could cause interruption of the flow of Ryan Gulch. Approximately 580 acres (11 percent) of the tract is an alluvial valley.

### C-18 Alternative

Development of the C-18 Tract could materially damage quality and quantity of water supplied to the Yellow Creek alluvial valley.

Direct damage to possible alluvial valleys as described above for C-11 is not expected to be significant. Only 130 acres (2 percent of the tract) of alluvial valleys occur on the C-18 Tract.

### Combined Alternative

Under this alternative, all the impacts discussed above would occur.

### Summary

The No Action Alternative would have the least impact on alluvial valleys. The Combined Alternative has the greatest impact on alluvial valleys. Development of the C-11 Tract could materially damage the water supply to the alluvial valleys of Ryan Gulch, Horse Draw and Piceance Creek. Development of C-18 Tract could materially damage the water supply to the alluvial valley of Yellow Creek.

## AGRICULTURAL LANDS

On-tract development would impact rangeland which is included under the category of agricultural lands. This impact will not be discussed here, but is

included in Chapter IV, Vegetation Types and Grazing.

Some off-tract development such as pipeline routes and utility corridors may temporarily impact agricultural lands (including prime farmlands and irrigated pastureland and hayland of statewide importance). This should not be a significant problem as such lands can be successfully reclaimed within several years.

Permanent impacts to agricultural lands from population growth and the associated conversion of agricultural lands to urban development could be significant. Although it can not be determined at this time, urban development in Mesa County could impact orchard lands. Further losses of orchard acreage due to this development could significantly harm the Colorado fruit industry (see Public Comment Letter 46d). Table IV-6 shows the acres and percentage of land converted from cropland to other uses by county and alternative.

Insignificant impacts should occur to agricultural lands from reduction of surface water flow after implementation of the water augmentation plan as described in Chapter IV, Hydrology.

# SOILS

## Introduction

The No Action Alternative would have the fewest impacts on the soil resource. The Combined Alternative would have the greatest impact on the soil resource. Development of Tract C-11 could seriously impact the productive potential of the soils on the tract. Development of Tract C-18 could be less impacting to soils than development of the C-11 Tract.

## Facility Sites

Facility sites would cause displacement of soil on the site location until these sites are abandoned and removed at the end of mine life. Topsoil from surface facility sites would be stockpiled for the life of the mine and lose organic matter, nitrogen, phosphorous, and valuable soil microorganisms (Redente and Cook 1981). Therefore some reduction in soil fertility can be expected. The amount of land committed to facility sites will vary by development technology and alternative (Table IV-7).

## Surface Disturbance

### Spent Shale Disposal

The direct mining with surface retort technology could be the most impacting to the soil resource. Although the amount of surface disturbance is less than that of true in-situ development, a more radical transformation of the landscape is anticipated because of the large amount of material that must be disposed of on-tract. About 1,000 acres (20 percent of the tract) would be covered with a spoil pile.

Spent shale is not suitable plant growth material because of high salt content, high pH, trace element problems, and a low copper to molybdenum ratio (Dean et al 1979; Redente and Cook 1981; Harbert and Berg 1978; and Stollenwerk and Runnells 1981). Also, the black color (depending on the retort process) of the spent shale can cause the material to absorb large amounts of heat. Temperatures high enough (149°F) to kill seedlings have been recorded on south facing study plots (Harbert and Berg 1978). Because of these problems, spent shale should be covered with at least 24 inches of suitable plant growth material. On these tracts, less than 15 inches may be available from the disposal site to cover the spent shale pile. Because of material compaction during placement and later settling and erosion of this material, less than eight inches of suitable plant growth material could be available for plant growth at the end of mine life. This would severely limit the establishment of deep rooted plant species. For more details see Chapter IV, Surface Reclamation.

Mine assisted in-situ development would require less surface disposal of waste material than for the direct mining technique but the character of impacts would be similar. True in-situ development would not require surface disposal of waste, however this technology would have the greatest amount of surface disturbance requiring reclamation.

### Sideslope Soils

Sideslope soils; unit 63, Rentsac series; and unit RT, Torriorthents-Rockoutcrop complex; make up about 3,440 acres or 67 percent of Tract C-11 and 2,820 acres or 55 percent of Tract C-18. Disturbance of these soils would accelerate their already high erosion rates. This acceleration of erosion would last until completion of reclamation. This erosion could cause a permanent reduction in the productive potential of these soils. The relatively steep slopes and broken topography would cause recla-

TABLE IV-7
ESTIMATED QUANTITY OF SURFACE DISTURBANCE
BY ALTERNATIVE AND DEVELOPMENT SCENARIO

| Alternative | Surface Disturbance By Development Scenario (Acres | | | | | |
|---|---|---|---|---|---|---|
| | Direct Mining and 1/ Surface Retorting | | Mine Assisted In-Situ | | True In-Situ | |
| | Permanent | Temporary | Permanent | Temporary | Permanent | Temporary |
| No Action 2/ | -- | -- | -- | -- | -- | -- |
| C-11 | 400 | 1,000 | 200 | 1,000 | 200 | 3,000 |
| C-18 | 400 | 1,000 | 200 | 1,000 | 200 | 3,000 |
| Combined 3/ | Variable: permanent 400-800 acres<br>temporary 2,000-6,000 acres | | | | | |

1/ Permanent refers to disturbance occurring for life of the mine (e.g. mine facilities, surface retorts) whereas temporary (e.g. spent shale piles, borehole pads) infers short term surface disturbance reclaimable within 10-15 years.

2/ Assumes no additional tract leasing and consequently no further impacts to the existing situation. An estimated 20,000 acres of surface disturbance is expected from current energy activities considered under the No Action Alternative.

3/ The Combined Alternative has nine potential variables. The minimum and maximum disturbance acreages have been calculated to identify the range of potential consequence.

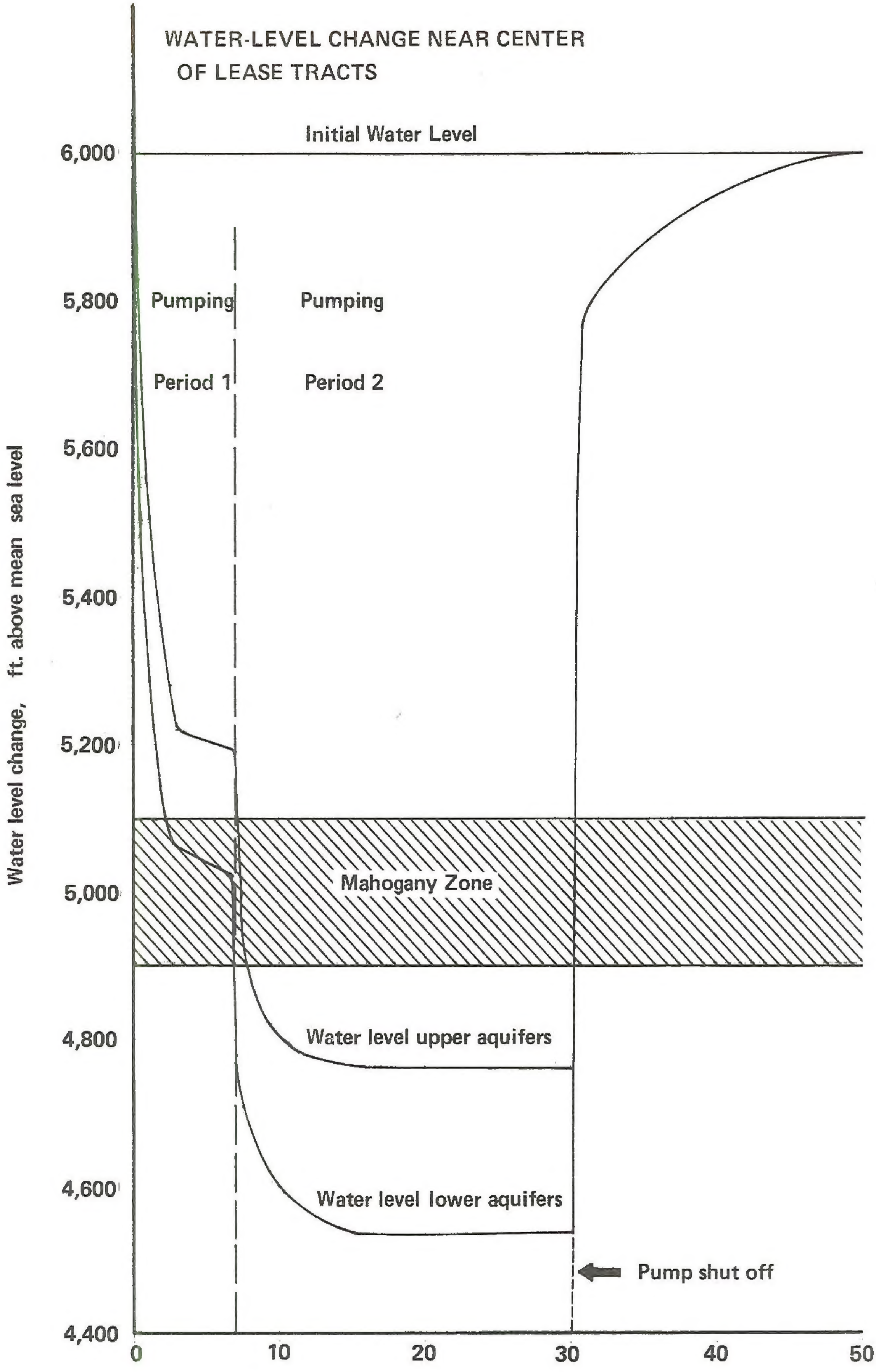



Figure IV-8 Water Level Change Near Center of Lease Tracts

mation to be difficult, as discussed in Chapter IV, Surface Reclamation.

### Bottom Land Soils

Bottom land soils; unit 38, Havre series; unit 41, Glendive series; and unit 75, Barcus series; make up about 580 acres or 11 percent of Tract C-11 and about 130 acres or 2 percent of Tract C-18. Small scale disturbance of these soils would accelerate their erosion rates, but these rates, except near active gullies and stream channels, are low and this acceleration should not be detrimental if properly controlled. Reclamation should not be difficult unless strongly alkaline subsoil materials are mixed with the upper soil horizons. Large scale disturbance of these soils could interupt the flow of water through them which could change how they function as alluvial valleys (see Chapter IV, Alluvial Valleys).

### Upland Soils

Upland soils; unit X63, Rentsac-Piceance Complex; unit 66, Redcreek-Rentsac complex; unit 70, Piceance series; unit 71C, Forelle series; and unit 73 Yamac series; make up about 1,100 acres or 22 percent of C-11 tract and about 2,170 acres or 43 percent of C-18 tract. Units X63 and 66 are shallow and deep and have relatively high erosion rates. The other soils are moderately deep to deep and have relatively low erosion rates. Disturbance would accelerate these erosion rates which could cause some loss of productive potential on the shallow soils units. Reclamation of the other uplands soils should not be difficult because of the relatively high quality of these soils.

## Differences Between Alternatives

Under the No Action Alternative, 177 acres would be disturbed on the tracts by development of a sodium mine. Leasing Tract C-11 could be more damaging to the soil resource than leasing C-18 because of the large amount of south facing slopes with shallow and erosive soils on Tract C-11. Tract C-11 also has greater amounts of soils associated with alluvial valleys which are the most productive soils in the Piceance Basin (see Chapter IV, Alluvial Valleys).

# HYDROLOGY

Impacts to the hydrologic system were analyzed using established computer models provided by the U.S. Geological Survey (Taylor 1982) and the Bureau of Reclamation (1981). Baseline information used in these models included the effects of other activities occurring in Piceance Basin upon the water resources, (see Chapter II, No Action Alternative). The models analyzed a worst case development scenario of 100,000 bbls/day, (leasing of both tracts at 50,000 bbls/day each). Because the impacts for the lower development levels would be less than the worst case, these levels are described as a percentage of the worst case analysis. This section describes the results of the modeling efforts for impacts to groundwater quantity and quality followed by impacts to surface water quantity and quality. Recommended mitigation follows at the end of each of these sections.

Modeling results indicate there could be significant impacts to Piceance Creek, Yellow Creek, and possibly to springs, and wells unless proper mitigation measures are taken.

## Groundwater Quantity

### No Action Alternative

The No Action Alternative assumes that mines at both Tracts C-a and C-b will have to be dewatered. It is estimated that long-term pumping rates of 5 and 15 cfs would be necessary to sufficiently lower the potentiometric head at Tract C-a and C-b, respectively (Robson and Saulnier Jr. 1981). Springs and wells located in the area could be affected as a result of the large drawdowns (Robson and Saulnier Jr. 1981). The impacts to the surface flows resulting from mine dewatering are described in the surface water quantity section.

### Development Alternative

Mining of the two proposed lease tracts could have an additional significant impact on the groundwater system of Piceance Basin. There is a considerable amount of groundwater surrounding the minerals which are proposed to be mined. Mine dewatering, regardless of the development scenario or tract leased, will have to take place if the minerals above the Saline Zone are to be mined. Impacts will vary by production rate only, as discussed below.

***Groundwater Model***

# CHAPTER IV

The Water Resources Division of the U.S. Geological Survey was requested to simulate mine dewatering utilizing an existing groundwater model (Taylor 1982). For a description of the model, input parameters used, assumptions, and methodology utilized, the reader is referred to Taylor (1982). The model simulates interactions between adjacent aquifers of differing hydrologic characteristics and also interconnections between ground and surface water systems of the area. For the purposes of this analysis, a worst case scenario of leasing both tracts at 50,000 bbls/day production (100,000 total) was analyzed.

Since computer models can only provide estimates, conclusions drawn from this model should be viewed in this light. Mine drainage and dewatering is a complex process and actual rates will only be known when the mine development process begins.

### *Mine Dewatering*

This analysis assumes that groundwater levels in both aquifers would have to be lowered to an elevation of 4800 feet. Dewatering would be accomplished by the use of dewatering wells equally spaced throughout both lease tracts. For the model simulation, wells were completed in the bedrock aquifer below the Mahogany Zone. Over a 30 year pumping period, the simulation wells drained both the upper and lower aquifers which surround the Mahogany Zone.

The model assumes that there is an impaired but continuous hydrologic connection between the bedrock aquifer and Piceance and Yellow Creeks. This assumption is based on the field observations that (1) the potentiometric surfaces of the upper and lower bedrock aquifers slope toward the valleys of Piceance and Yellow Creeks, indicating that the groundwater discharges into these valleys, and (2) on March 26, 1981, measured gains of flow in Piceance Creek from groundwater total about 15 cfs and probably represent water discharged from the bedrock aquifers. It was also assumed that Piceance and Yellow Creeks were infinite sources of water and could continue to be depleted even after historical flows were gone.

Mine dewatering was divided into three pumping periods. The first period lasted seven years and the pumping rate was 37.5 cubic feet per second (cfs) or approximately 27,000 acre feet/year. The second period lasted 23 years and the pumping rate was 52.5 cfs or 38,000 acre feet/year. The third period was a recovery period.

The large pumping rates partly relate to the location of the lease tracts between Piceance and Yellow Creeks. Another reason for such large pumping rates is that the potentiometric head of the lower aquifer below the Mahogany Zone at the lease tracts is approximately 1,200 feet. The water levels in this artesian aquifer would have to be lowered this distance just to maintain water table conditions at the bottom of the Mahogany Zone. Even larger pumping rates would be required to lower the potentiometric head below this level, so as to be able to mine the R-6 Zone.

A cross section through the middle of the tracts displaying modeled water level changes versus time is shown in Figure IV-8. Water levels for both aquifers declined rapidly during the first two years of pumping and then leveled off after the third year. At the rate of pumpage assumed for period one, 37.5 cfs, the water levels would not be lowered below the Mahogany Zone during the 30 year lease period.

When pumpage rates were increased during the second period (52.5 cfs), groundwater levels again declined rapidly during the first two years of pumping. The groundwater systems then leveled off at approximately 4780 feet and 4540 feet for the upper and lower aquifers, respectively. These levels are below the Mahogany Zone, and are sufficient for mining.

After 30 years the pumps were shut off. At this point the groundwater system was allowed to recover. The recovery rate of the system was nearly back to pre-dewatering conditions after three years, as a result of the recharge from the two creeks to the bedrock aquifers. If the streams were mostly dry or poorly connected to the bedrock aquifers, the recovery rate would be much slower.

During period one, approximately 27,000 acre ft/yr of water would be pumped during dewatering. For period two, approximately 38,000 acre ft/yr of water would be taken from the groundwater system. Assuming the high development alternative for both tracts, 16,000 acre ft/yr of water would be required for development. Using the pumping quantities of period two, there would be an excess of 22,000 acre ft/yr of water which would have to be treated if necessary and returned to the system.

### *Mine Dewatering With Reinjection Wells*

Reinjection practices are being conducted on Tracts C-a and C-b. For the analysis of C-11 and C-18, an additional model run was made assuming reinjection of excess water into the lower aquifer from which it came. The reinjection wells were located on the perimeter of the lease tracts. The results of this model run indicates that even at the high pumping rate of period two, sufficient dewatering was not attained to dry the proposed mining area. This analysis shows that onsite reinjection of the surplus water is not possible, (using the as-

sumptions and water quantities described in the mine dewatering section).

Offsite reinjection was not examined and is a possible mitigation alternative. Additional study is required for offsite reinjection to determine the best location of reinjection wells from a hydrologic and economic standpoint. Additionally, the quality of the reinjection water must be determined to ensure compatibility with the waters in the reinjection zones.

#### *Surface Discharging of Excess Mine Water*

Controlled discharge of excess mine water into existing drainages is another possibility for disposal. This is dependent upon the quantity and quality of the mine water. The quantity of excess water which could be discharged into the stream channels would be a function of existing stream flows. The sum of the channel flows plus the discharge of excess dewatering water should not be allowed to cause increased channel erosion. Excess water may have to be treated depending upon its quality. National Pollutant Discharge Elimination System (NPDES) permits would have to be obtained for this action from the State of Colorado.

#### *Impacts to Existing Sources*

Figure IV-9 shows the area in which model simulated declines of more than 10 feet occur in the potentiometric surface of the upper bedrock aquifer. Any springs or wells which derive their water source from the bedrock aquifer system within this zone could be affected by the dewatering. Mitigation for the lost sources could be either by direct replacement or offsite reinjection. The springs and wells located within the area identified in Figure IV-9 would have to be monitored to determine the impacts to the sources caused by mine dewatering.

#### *Mine Development Alternative*

Impacts associated with different development alternatives would be less than the high level of development (100,000 bbls/day), addressed by the modeling method. For example, the impacts to the groundwater system caused by mining one tract at a production level of 25,000 bbls/day are less than that of 100,000 bbls/day. This is because a smaller portion of the groundwater system would have to be dewatered at the lower level of production.

#### *Effects on Groundwater of Mining the Saline Zone*

If mining is to take place only in the saline zone, a shaft could be placed through the upper and lower aquifer and properly sealed with grout and water rings, greatly reducing the amount of dewatering that would be necessary. The resulting shaft drainage would be significantly less than the analysis above and could be pumped to the surface and treated for use in processing. Pilot holes will have to be drilled to test both the quantity and quality of water before dewatering techniques can be developed (Multi Mineral Corporation 1981).

The saline zone (explored at the Bureau of Mines shaft) was found to be a very tight formation, containing very little water. If this case holds, a sufficient layer of this zone would have to be left above the mine to prevent inflow of water from the lower aquifer. If water was allowed to flow into the mine there would be a large increase in the dissolved solids concentrations of that water. Because very little is known about the hydrologic characteristics of the saline zone, it is not possible to quantify hydrologic effects from mining, beyond the above discussion.

## Groundwater Quality

### No Action Alternative

Under the No Action Alternative dissolved solids concentrations around Tract C-b would remain fairly constant except in the deeper portion of the lower aquifer. Dissolved solids concentrations could be decreased by as much as 1,100 milligrams per liter (mg/l) in the deepest portion of the lower aquifer if the mine was pumped at a rate of 15 cfs (Robson and Saulnier Jr. 1981).

Dewatering of the mine at Tract C-a would also decrease the dissolved solids concentrations around the mine in the lower aquifer. Decreases of 400 mg/l could occur as a result of downward movement of the upper aquifer water which contains fewer dissolved solids than the lower aquifer water (Robson and Saulnier Jr. 1981).

The improvement of the lower aquifer water at both C-a and C-b will result at the expense of the higher quality upper aquifer water.

### Development Alternative

Significant impacts to groundwater quality could occur at the proposed lease tracts as a result of any production rate. Impacts will vary by development scenario only. In-situ retorting associated with either the mine assisted in-situ or true in-situ scenarios has the potential for creating the greatest impacts (worst case) and will be addressed here. The two principal groundwater quality problems of concern are contamination from aquifer mixing and leaching of flooded retorts (including mines that have been backfilled with spent shale).

#### *Aquifer Mixing Through Mine Development*

An increase in aquifer mixing would occur as a result of dewatering. While movement of water between aquifers occurs naturally, (as described in Chapter III, Hydrology), mine dewatering will greatly increase this movement. Aquifer mixing will also occur after the mining operation has ceased, and the Mahogany Zone has been extracted. By removing this relatively impermeable stratum, water will be allowed to move between the two aquifer systems at a higher rate, a condition that mine void backfilling will not completely mitigate.

### *Leaching of Subsurface Retort Chambers*

Leaching of flooded in-situ retorts could potentially be a more serious problem than aquifer mixing. Because the control of retort process contaminants is more difficult to achieve underground than with surface retorting, leachable organic and inorganic residues would be left in many of the in-situ retorts at the completion of the oil extraction process (Wagner et al 1981). The contaminants which are most likely to increase are pH, sulphates ($SO_4$), sodium (Na), chlorine (Cl) and certain trace elements including vanadium (V), molybdenum (Mo), and lead (Pb). In addition, there should also be an increase in certain organic compounds such as phenols and organic nitrogen (Wagner et al 1981).

Movement of these pollutants through the groundwater system may take centuries after site abandonment because flow velocities are so low. In-situ leachates carried by groundwater may discharge into Piceance and Yellow Creeks, causing the quality of these streams to deteriorate. Impacts to surface water quality are discussed in Chapter IV, Surface Water Quality section under the Surface Water Impacts From In-Situ Leachates section.

The groundwater impacts associated with in-situ leachates are highly site specific and vary greatly with local hydrology. Leachate released from a single retort located near Tract C-a, once hydrologic equilibrium is reestablished, could continue from two to six years and transport through the lower aquifer would be about 160 ft/yr (Fox 1980). If the same retort were located on Tract C-b, leachate release could take from 6 to 60 yrs, and transport in the upper aquifer would be at a rate of approximately 20 to 30 ft/yr (Fox 1980). Estimates made for transport of leachates through the lower aquifer at the proposed lease tracts are approximately 102 ft/yr. The reader should use caution using these numbers because they are gross estimates, arrived at by use of Darcy's Law, using an assumed effective porosity of 0.01. Assumed permeabilities for the lease tract areas were 0.94 ft/day and the hydraulic gradient used was 14 ft/mile (Multi Minerals Corporation 1982). In addition, because the porosity is fracture-controlled, Darcy's Law may not accurately describe the flow mechanism. Groundwater flow equations describing movement of pollution through fractured media is not well understood. Further research on this problem needs to be done.

Once the leachate enters the aquifer, leachate concentration will be diluted by absorption, dispersion and other natural processes. The reduction in concentration of leachates will depend upon the following factors:

- distance from source in direction of groundwater flow,
- concentration of solute in the source,
- effective dispersion coefficient,
- groundwater flow velocity,
- time,
- porosity, and
- the quantity of absorption per unit volume of leachate.

Because very few of these factors are actually known about the groundwater system near the lease tract, no attempt was made to determine the effect of dilution on the quantity of leachate transport.

### *Leaching of Surface Spent Shale*

Groundwater pollution resulting from the leaching of surface spent shale spoil piles is primarily a function of pile permeability. Permeability factors estimated for the Paraho and Tosco processes at maximum applied stress (800 psi) vary from 0.26 ft/yr to 0.48 ft/yr (Bloomfield and Stewart 1981). By wetting to optimum moisture and compacting spent shale piles to 90 percent Proctor density, minimum permeability is assured (Margheim 1975). With the proper compaction, the piles essentially become impermeable reducing the potential for groundwater pollution to a minimum (Margheim 1975). Additional discussion of potential impacts to groundwater quality resulting from leaching of spent shale piles and subsurface retorts is contained in Chapter IV, Surface Reclamation.

### *Effects of Mine Dewatering*

Shaft and mine dewatering could change the local direction of groundwater flow in the aquifer systems. The change in flow direction would have an impact on the groundwater system. Simulated mine dewatering conducted on Tract C-b indicated that a decrease in dissolved-solids concentration of as much as 1,100 milligrams per liter (mg/l) would occur in the deepest part of the lower aquifer (Robson and Saulnier Jr. 1981). Downgradient from the mine however, dissolved-solid concentrations would increase by as much as 50 mg/l. Similar impacts are assumed to occur in the vicinity of the proposed lease tracts.

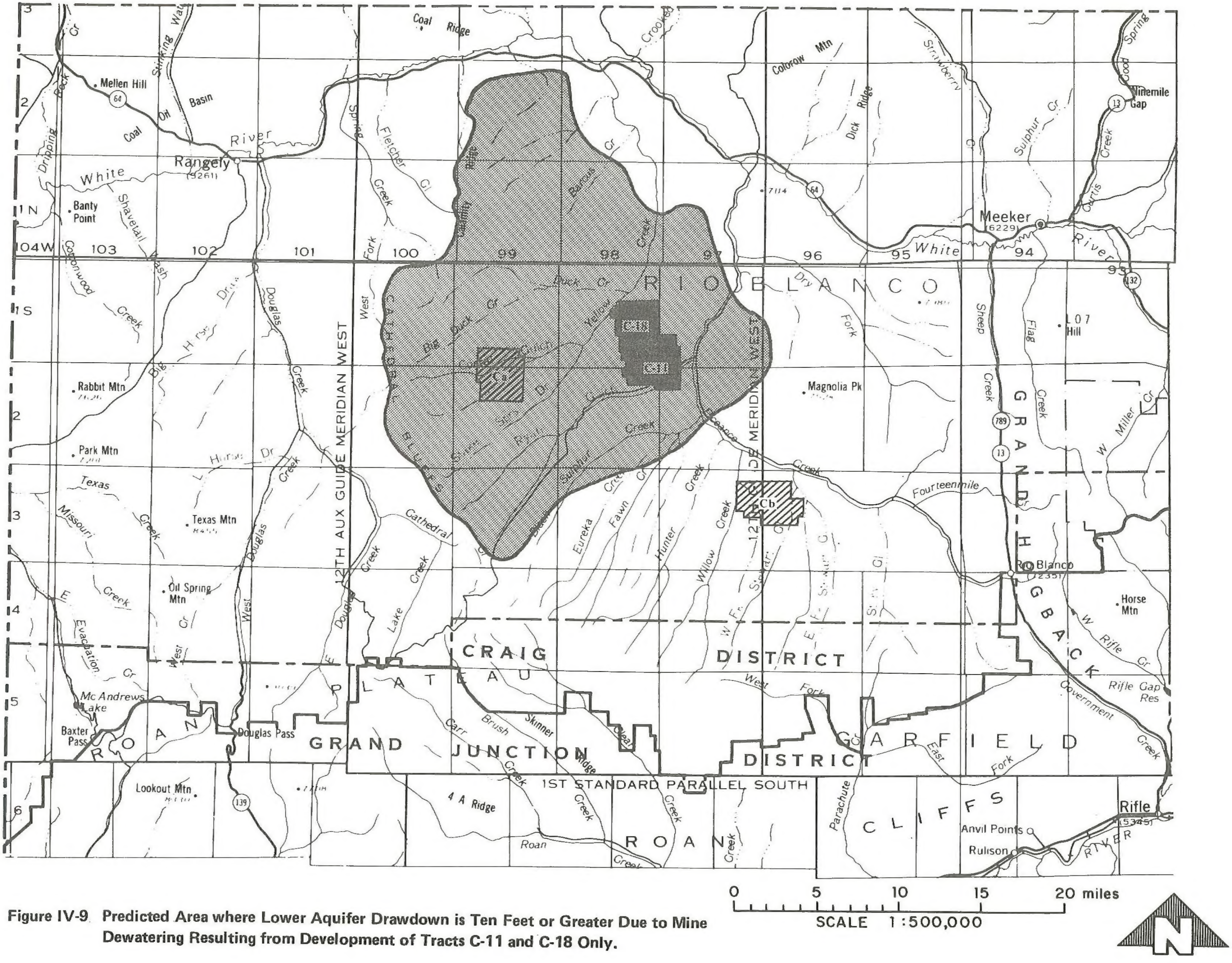



**Figure IV-9 Predicted Area where Lower Aquifer Drawdown is Ten Feet or Greater Due to Mine Dewatering Resulting from Development of Tracts C-11 and C-18 Only.**

TABLE IV-8
NO ACTION ALTERNATIVE

CONSUMPTIVE WATER USE FROM
THE WHITE RIVER (ACRE FEET)

| Item | 1982 | 1988 | 1993 | 2000 | 2013 |
|---|---|---|---|---|---|
| C-b | 0 | 6,000 | 8,000 | 12,160 | 12,160 |
| C-a | 0 | 6,000 | 8,000 | 16,000 | 16,000 |
| Other Energy Development 1/ | 0 | 7,000 | 12,000 | 23,400 | 27,400 |
| Population Increases 2/ | 0 | 1,000 | 2,000 | 2,000 | 2,000 |
| Agricultural Uses 3/ | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 |
| Total | 35,000 | 55,000 | 65,000 | 88,560 | 92,560 |

1/ Includes oil and gas use, sodium, coal and oil shales.

2/ Assume 100 gal/day/person. Population projections were based on the high level of development for Meeker and Rangely as identified in Chapter IV, Social.

3/ Includes existing Agricutural use within the White River basin.

*Groundwater Use*

Groundwater within the Piceance Basin is presently not extensively used. It does however, support most of the surface stream flows. Most of the existing wells have been developed in the alluvial aquifers. Therefore, short-term groundwater impacts may not be serious. In the long-term, groundwater within the vicinity of the lease tracts may not be suitable for municipal or stock watering without treatment.

*Groundwater Mitigation*

To reduce impacts to the groundwater system, several mitigating measures could be taken. Proper site selection of the mining area is one of these. Leachate transport would be reduced by isolating the retort within a zone of relatively impermeable strata (such as the Mahogany and Saline Zones), and leaving a sufficiently thick layer of strata between aquifers. Additional studies need to be conducted to determine the feasibility of this process in the mining operation.

Grouting or filling of a mined area with an insoluble material would minimize seepage of groundwater into the area thus isolating the retort and the resulting leachates. Again, data is very scarce on flooded retorts and mines and their leaching properties. Additional studies are needed to determine the effectiveness of this method.

Another mitigation method which could be considered is back flooding the retort to intentionally leach the spent shale. After leaching has taken place, the leachate would be removed by pumping and treated on the surface. If the above mitigation measures are found feasible and implemented, the impacts to groundwater quality from the leachates and contaminated waters may be minimized.

Statutory regulations which govern groundwater are outlined in the surface water quality section. A new set of regulations governing underground injection have been adopted by EPA and are addressed in 40 CFR Sections 122, 123, and 146. Additional groundwater data is needed to determine how these new regulations will apply to site-specific areas in the Piceance Basin.

Because of the low rates of flow typical of the groundwater system of the lease tracts, a long-term monitoring program is recommended after retort abandonment. Impacts to the groundwater system may not show up for hundreds of years after abandonment. It is also assumed that monitoring will be conducted during mining as specified in the Environmental Stipulations of the lease, Section 9. To assure that environmental impacts of oil shale development are fully assessed, all facets of dewatering, mining, retorting, and disposal of wastes which impact water resources should be extensively analyzed and monitored during the development stage.

## Surface Water Quantity

### No Action Alternative

Assessment of the impacts on surface water under the No Action Alternative are shown in Table IV-10. The No Action Alternative assumes that Tracts C-a and C-b would be developed. The depletions to both Yellow and Piceance Creeks were determined by the U.S. Geological Survey, (Robson and Saulnier Jr. 1981). Depletions of 18 cubic feet per second (cfs) for Piceance Creek, and two cfs for Yellow Creek do not consider reinjection or any other augmentation and are considered to be a worst case. Depletions of this nature would cause Piceance Creek to experience extended periods of no flow during summer months. The flow in Yellow Creek could be reduced by 50 percent after 30 years of dewatering. Yellow Creek currently experiences periods of no flow (see Table III-9). A reduction of this magnitude would cause Yellow Creek to remain dry over half the time.

### Development Alternatives

*Surface Water Modeling*

Impacts to surface water on the White River were estimated using the Bureau of Reclamation's Colorado River Simulation System model (Bureau of Reclamation 1981). The modeling runs were developed using hydrologic data based on the 1951 period to simulate a normal cycle. The baseline from which the impacts were developed are outlined in Table IV-8. The Colorado River Simulation model predicted the flows of the White River at the confluence with the Green River for production levels of 50,000 and 100,000 bbls/day as shown in Table IV-9.

*Impacts to the White River*

Development at the 100,000 bbls/day level would cause a reduction in flow of the White River of approximately four percent, at the confluence with the Green River. The reduction in flow of the White River associated with development of a 50,000 bbls/day industry would be two percent, and a 25,000 bbl/day production would be one percent. Reductions in flow of the White River at these levels are considered insignificant. However this water would be lost for other uses, such as agriculture, which may be significant.

TABLE IV-9
PREDICTED FLOWS AND PERCENT REDUCTION FOR
THREE DIFFERENT PRODUCTION LEVELS OF THE
WHITE RIVER AT THE CONFLUENCE WITH THE GREEN RIVER
(1000 ACRE-FT/YR)

| | No Action | 50,000 bpd | 100,000 bpd |
|---|---|---|---|
| Baseline 1/ | 450 | 450 | 450 |
| Depletions | 0 | 8 | 16 |
| Net Flow | 450 | 442 | 434 |
| Percent Change | 0 | 2 | 4 |

1/ Baseline conditions were computed using Bureau of Reclamation's Colorado River Simulation System Model, and include the depletions outlined in Table IV-8. The quantities listed are model generated flows based on a 29 year average using the 1951 flow period (Bureau of Reclamation 1981).

TABLE IV-10
ESTIMATED SURFACE WATER DEPLETIONS RESULTING
FROM OIL SHALE DEVELOPMENT IN THE YEAR 2013 IN CFS

| | No Action 1/ | 50,000 bpd 2/ | 100,000 bpd 2/ |
|---|---|---|---|
| Piceance Creek | 18 | 16 | 27 |
| Yellow Creek | 2 | 12 | 25 |

1/ Assumes stream flow depletions as stated in USGS professional paper 1196 (Robson & Saulnier 1981).

2/ These depletions are in addition to the No Action Alternative.

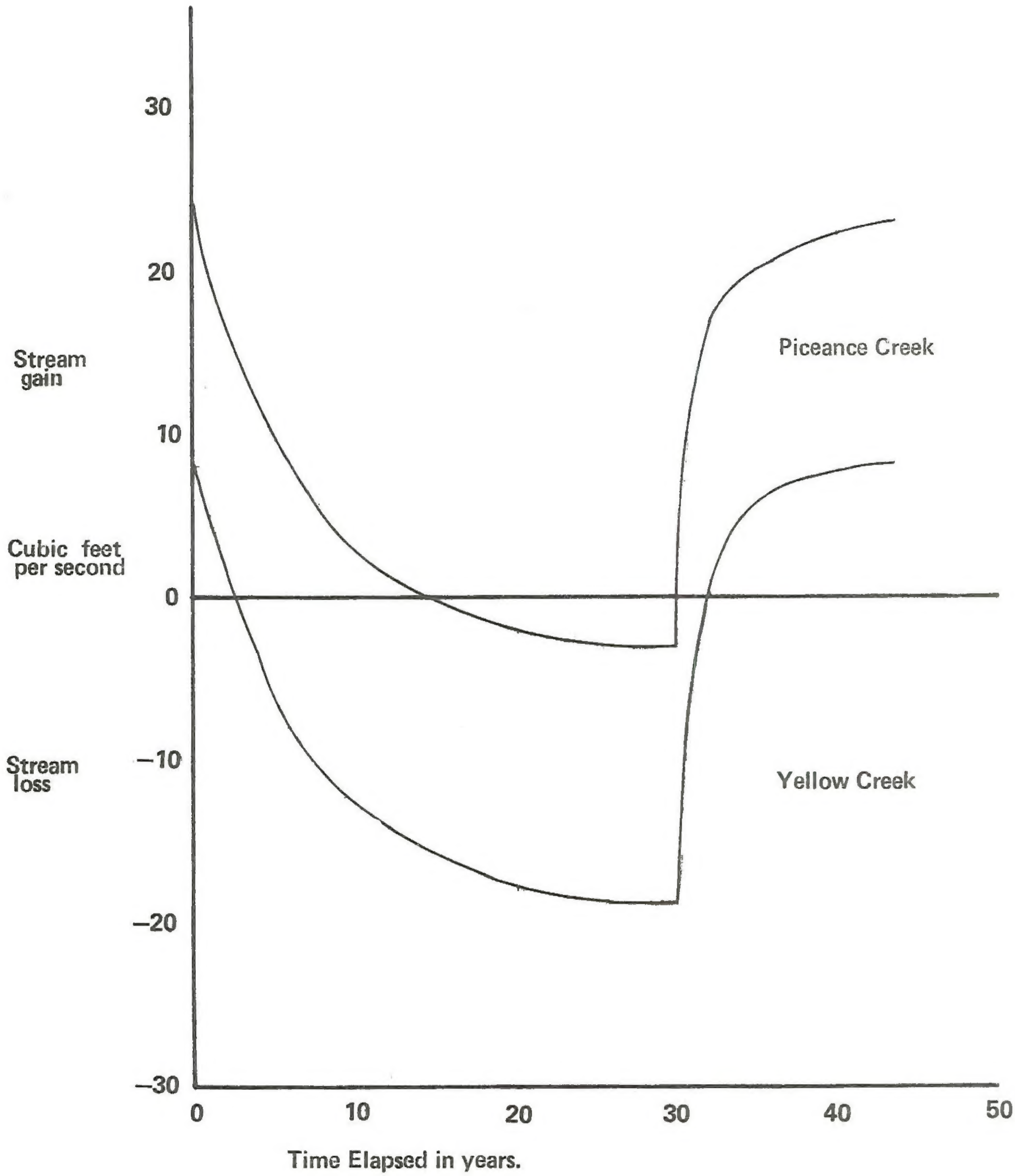



**Figure IV-10 Streamflow Depletions Resulting From Simulated Mine Dewatering**

These reductions are based upon obtaining all water needs from the White River Basin at a rate of four barrels of water per barrel of shale oil produced. No attempts were made to determine the source of the water needed for oil shale production beyond the White River Basin or any impact resulting from augmentation water. Water rights will have to be obtained through the State's appropriation system, and any augmentation plans must have state approval. Assumptions as to the source of project water beyond the general one of the White River Basin are beyond the scope of this EIS.

Because of the relationship between the bedrock aquifer and the stream systems in the Piceance Basin (see Chapter III, Surface Water Quantity and Chapter IV, Mine Dewatering), the use of groundwater as a source for oil shale development is considered in the 16,000 acre ft/year needs for a 100,000 bbls/day industry. Thus, from the quantity standpoint, the use of groundwater to satisfy production needs is considered as a depletion of the White River just as Piceance or Yellow Creek water would be.

The four barrels of water per barrel of shale oil produced is consistent with the water requirements used for the No Action Alternative. Estimates for consumptive water use for mine assisted in-situ range from 1.7 to 6.6 barrels of water per barrel of oil produced (Lewin and Associates 1982). True in-situ consumptive use estimates range from 0.01 to 2.4 barrels of water per barrel of oil produced (Lewin and Associates 1982).

#### *Impacts to Piceance and Yellow Creeks*

Surface water impacts modeled by the U.S. Geological Survey (described in the Groundwater section) were based upon the assumption of impaired but continuous connection between surface and groundwater systems. The model determined that significant depletions of Yellow and Piceance Creeks could occur and were directly due to mine dewatering. As a worst case analysis the model continued to deplete Piceance and Yellow Creeks even after historical flows were gone.

The predicted surface water depletions for the development of both tracts at either 25,000 and 50,000 bbls/day each or just one tract at 50,000 bbls/day for both Yellow and Piceance Creeks are shown in Table IV-10. Using these model-estimated depletions, Piceance and Yellow Creeks would become intermittent streams flowing only during snow melt or rainfall events.

Figure IV-10 is a graphic example of streamflow depletions through time as predicted by the model. A majority of the streamflow depletions occurred during the first seven years when pumping rates were 37.5 cfs (see the Groundwater section). The model indicates that groundwater contribution to Yellow and Piceance Creeks would be reduced to zero approximately 3 and 13 years respectively after pumping begins.

One of the primary reasons for such large depletions of the surface water resource is the proximity of the lease tracts to the creeks. The lease tracts are located between the two major drainages of the Basin. Tract C-11 encompasses Ryan Gulch, a major tributary to Piceance Creek, and the tract boundaries are within one-half mile of Piceance Creek. Tract C-18 borders Yellow Creek for approximately one mile along the northwest corner.

#### *Surface Water Recovery with Cessation of Mine Dewatering*

The model predicted that recovery of the system would occur at a greater rate than depletion. Depletions of groundwater to the streams decreased rapidly for the first two years after dewatering had ceased. The system was almost back to the premining condition 10 years later.

#### *Surface Water Mitigation*

The potential impacts to both Piceance and Yellow Creeks can be mitigated by either an augmentation plan, purchase of existing water rights, or exchange of water rights. Replacement water can be obtained using a water delivery system from either the White or Colorado Rivers. Water from groundwater sources can be made available to the streams, providing that this water is of similar quality as the water which has been depleted.

Colorado State law protects both surface and groundwater rights holders; thus, one of the mitigating measures described above must be done. The State of Colorado requires that water rights be acquired for any water use. Any augmentation plan must be approved by Water Division 5 Water Court, State of Colorado. Monitoring of the surface water within and adjacent to the lease tracts must be conducted for development of an effective augmentation plan.

## Surface Water Quality

### No Action Alternative

Under the No Action Alternative, salt loads delivered to the White River from Piceance and Yellow Creeks could be reduced by as much as 20,000 tons per year. This amounts to a salinity reduction of approximately two mg/l as measured at Imperial Dam. These salt load estimates were determined using the streamflow reductions to both Piceance and Yellow Creeks that were outlined under the No

Action Alternative in the Surface Water Quantity section, and an average dissolved solids concentration of 1,100 mg/l for both creeks (Robson and Saulnier Jr. 1981). In determining these estimates, it was assumed that the streamflow depletions resulting from mine dewatering (Robson and Saulnier Jr. 1981) would be completely consumed in oil shale production. Actual salt load reductions should be less.

In addition to the estimated salt load reductions, leachates from in-situ retorts and spent shale disposal piles could also have impacts on Piceance and Yellow Creeks. The impacts of leachates on surface water will be discussed later in this section. Water quality problems could develop during construction, mining, processing and as a result of disposal of spent shale and would be similar to those described under the Development Alternative.

### Development Alternative

Development of the proposed lease tracts could affect the surface water quality of the area. The potential for water quality problems exists during construction, mining, processing, and disposal of spent and raw shale.

#### *Construction*

Construction activities will increase sediment yields regardless of the type of shale retort and mining process used or tracts leased. Lower production rates would have proportionately less impact than the development of both tracts at 50,000 bbls/day each.

During construction of the two tracts, sediment yields would increase by approximately two to four acre feet per square mile (Frickel et al 1975). Throughout the construction stage, stream sediment load and siltation could be minimized by contour-grading of disturbed areas, and installation of runoff-retention structures, as stated in the Environmental Stipulations of the lease, Section 11. If these measures are put into place as soon as possible, impacts associated with sedimentation would be minimal.

#### *Mining*

The impacts to the surface water system will primarily be a result of mine dewatering. Decreased flows of the surface water streams will reduce the salinity concentration in the Colorado River. Using the results of the mine dewatering analysis (as described in the Groundwater section) and a TDS concentration of 1,400 and 1,900 mg/l for Piceance and Yellow Creeks, respectively (as described by Robson and Saulnier Jr. 1981); salt loads delivered to the White River from both Piceance and Yellow Creeks will be reduced by 6,130 tons per year. This salt load reduction is caused by further reducing the groundwater contribution to both Piceance and Yellow Creeks by approximately 4,350 acre ft/yr. The salinity reduction assumes that this water is used as part of the 8,000 acre ft/yr required for the 50,000 bbls/day production level.

Salinity decreases to the Lower Colorado River resulting from this salt load reduction as measured at Imperial Dam would be approximately 0.6 mg/l.

#### *Processing*

Retort water produced during oil shale processing may have an affect upon the water quality of the area. Retort waters are produced by the combustion and pyrolysis of organics, and the release of moisture in the shale. These waters contain high levels of many inorganic and organic constituents. Major constituents of retort waters are ammonia ($NH_3$), ammonium salts ($NH_4$), hydrogen carbonates ($HCO_3$), carbonates ($CO_3$), and sulphates ($SO_4$). The existence of toxic heavy metals has been found in retort waters. It appears that most of the heavy metals remain in the spent shale and have been addressed under Chapter IV, Hydrology, Leachates from Disposal Piles, below. Retort waters are a product of shale retorting. Their composition is highly dependent on the process used.

The quantity of retort waters produced in shale retort processing are estimated to range from 0.1 to 22.0 barrels of water per barrel of oil (Fox 1980). Water production is at the lower end for surface processes, and at the upper end for in-situ retorting. The high value of 22 barrels of water per barrel of oil was due to groundwater inflow at an unwatered site and is not realistic for production.

#### *Surface Disposal of Spent Shale*

Runoff derived from shale disposal piles may adversely affect surface water quality unless proper measures are taken. The drying of the spent shale piles tends to cause the movement of water by capillary action to the surface. When this water evaporates, it leaves the dissolved solids it contained on the surface. The deposits will dissolve during the next runoff event. Experimental data are available on the composition and concentration of dissolved solids on runoff from spent shale piles (Margheim 1975). Increases in dissolved solid concentrations of sodium (Na), calcium (Ca), magnesium (Mg), and sulphate ($SO_4$) would result. In rainfall simulation work conducted by Margheim (1975) on Tosco spent shale, an increase in TDS of 0.02 pounds for an 800 square foot area was observed. In order for these yields to be maintained at this level, dump slopes must be maintained at relatively low angles (8 to 10 degrees). Also, the shale must be moisturized and compacted to a 90 percent Proctor density.

The concentration of leachate and the amount of surface runoff to be obtained from spent shale piles is dependent upon the following factors:

- success of revegetation,
- spoil pile location,
- compaction of the pile,
- the drainage system established around and over the piles,
- sediment control system located below the piles,
- the engineering properties of the spent shale as related to slope stability and erodibility,
- the engineering properties of the raw shale,
- the geochemistry of the spent shale,
- the geochemistry of the raw shale,
- initial water content of the shale,
- the amount of water being added (mean annual precipitation or irrigation water),
- particle size of the shale,
- if preleaching occured, and
- process or retorting method used.

With the proper mitigating measures, the impact to surface water quality from spoil pile runoff can be minimized. These measures are discussed in the Mitigation section. Additional information concerning disposal can be found in Chapter IV, Surface Reclamation and Waste Disposal.

***Leachates from Disposal Piles***

Leachates from spent shale spoil piles may contain high concentrations of Sodium (Na), Calcium (Ca), Magnesium (Mg), and Sulphate ($SO_4$). At low concentrations these constituents are not detrimental for many water uses. Some of the minor components in spent shale leachates can be toxic to plants, animals, and humans. These include the toxic metals lead (Pb), boron (Bo), and molybdenum (Mo). Also concentrations of fluoride (F), lithium (Li), phenols, and organonitrogen are sufficiently high to warrant further investigation (U.S. Department of Interior 1980).

The quantity and quality of raw oil shale leachates will be somewhat different from that of spent oil shale leachates. Leachate from raw shale may be in greater volume per unit area and could have similar or even higher levels of total dissolved solids (TDS) and inorganic constituents. The pH, carbonates ($CO_3$), hydrogen carbonate ($HCO_3$), and selenium (Se) contents are not significantly different (Fox 1980).

***Surface Water Impacts From In-Situ Leachates***

The movement of leachates from the retorts into the groundwater aquifer, and to the stream channels will eventually occur. Estimates made concerning leachate transport at Tract C-a indicate that it will take a minimum of one century for the leachates to reach Yellow Creek (Fox 1980). Fox (1980) also estimated that it will take a minimum of two centuries for leachates to reach Piceance Creek from an abandoned retort at Tract C-b.

It is estimated that it will take a minimum of 120 years for leachates from an abandoned retort at Tract C-11 to reach Piceance Creek, and a minimum of 105 years for leachates from an abandoned retort at Tract C-18 to reach Yellow Creek. These estimates were made using the assumption that a retort would be located in the middle of the lease tracts, and the leachates would travel through the lower aquifer at a rate of 102 ft/yr (see Chapter II, Groundwater Quality) and discharge into the stream reach which is the closest distance to the retort. The distances used were 2 1/4 miles from C-11 to Piceance Creek, and 2 miles from C-18 to Yellow Creek. Mitigating measures are described in Chapter IV, Groundwater Quality which should reduce the quantity of leachates, and thus the potential impact to the stream channels.

***Leachates Associated With Nahcolite and Dawsonite Recovery***

Water quality problems associated with the recovery of sodium and aluminum from nahcolite and dawsonite could occur unless proper treatment and disposal of resulting effluents are taken. The recovery of sodium minerals will most likely be accomplished by a leaching process. If the recovery is to take place from retorted shale, the retort must be operated at temperatures less than 650°C to prevent the sodium minerals from becoming insoluable.

Very little information is currently available on the water quality problems associated with the recovery of sodium and aluminum from nahcolite and dawsonite. Work currently being conducted by the Bureau of Mines at the Albany Research Center indicates that through the recovery of sodium and aluminum, vanadium (V), molybdenum (Mo), boron (B), potassium (K), phosphorus (P), fluoride (F) and sulphate ($SO_4$) will also be made available (White 1982). Estimates of the quantity of these substances is currently not available. Proper disposal of these substances must be done to assure that they do not reach the surface water system.

By preleaching the spent shale for the recovery of sodium minerals, many of the compounds which would be leached from spent shale piles will already be removed prior to final pile formation. Thus, if these compounds are disposed of in an environ-

mentally sound way, the long-term cumulative impacts associated with oil shale development and sodium minerals recovery could be less than those obtained from spent shale piles which were not preleached.

#### *Mitigation*

The following mitigation is recommended to minimize pollution of surface waters from leachates and other process waters. These measures are the type specified in the Environmental Stipulations of the lease, Section 9:

1) Water be channeled around spoil piles.

2) Construction of drainage and collection systems to catch surface runoff and sediment from spoil piles.

3) Provide lined impoundments between the spoil pile and the stream channel.

4) Careful placement, compaction, wetting, and engineering of the spoil piles.

5) Detailed geochemical analysis of raw and spent shale should be done for determination of potential leachates.

6) The covering of spoil piles as soon as possible with an adequate mantle of non-toxic top soil and rapid revegetation.

Further study needs to be initiated into the disposal of process waters. Waters disposed of by evaporation or codisposal must first be stream stripped and treated to remove a majority of the organic and inorganic substances. These substances must then be disposed of in an environmentally sound way.

Wastewaters associated with domestic uses shall be collected and treated. Treated effluent can be used for revegetation or to supplement the water required for other processes.

A zero discharge policy similar to that outlined by C-a and C-b should be adopted on any new lease tracts.

### Monitoring

Monitoring of surface and groundwater resources (as specified in the Environmental Stipulations of the lease, Section 1(c)(2)(a)&(b) should be done in order to detect changes related to any of the above mentioned water quality problems.

### Statutory Regulations

There are federal and state laws designed to protect the quality of the surface and groundwater of the Piceance Basin. The Federal acts and standards which are applicable are:

1. Federal Water Pollution Control Act (PL 92-500)

2. Surface Mining Control and Reclamation Act (PL 95-87)

3. Resource Conservation and Recovery Act (PL 94-580)

4. Safe Drinking Water Act (PL 93-523)

5. Colorado River Basin Salinity Control Forum Standards

In addition, the State of Colorado has adopted water quality standards and effluent limitations. They include basic standards that apply to all state waters for both surface and groundwater, and additional standards which apply to specific waters. Specific water quality standards which apply to the proposed lease tracts are identified in the Colorado West Area 208 Plan. Colorado has also adopted an "Antidegradation Policy" which applies to both surface and groundwaters. This policy requires that state waters be maintained at existing quality unless it can be demonstrated that a change is necessary.

## VEGETATION

### Vegetation Types

The types and amounts of vegetation that would be disturbed vary between tracts and according to the mining method used. Table IV-11 summarizes the number of acres of surface disturbance that would occur for each development scenario by range site. This is shown for different uses on each tract (C-11 and C-18). The Combined Alternative would be the totals for both tracts, which would vary depending upon which development scenarios would be used.

For purposes of this "worst case" analysis, it is assumed that the most productive forage lands would be impacted.

### No Action Alternative

Under this alternative up to 20,000 acres in the resource area could be disturbed by coal mining, oil and gas drilling, oil shale development on Tracts C-a and C-b and sodium mining. These disturbances would mostly occur in the pinyon-juniper, sagebrush and mountain shrub vegetative types. These types, however, should not be significantly impacted because these disturbances represent only one percent of the resource area, and the disturbed areas would be reclaimed.

The only impacts on the tracts themselves would be due to the sodium leasing which would disturb a total of 177 acres. This would probably take place in the rolling loam or pinyon-juniper range sites. This impact should not be significant.

### Combined Alternative

At the end of the mine life all areas would be reclaimed that had not been completed previously (Environmental Stipulations of the lease, Section 11, Rehabilitation). It would take three to four years to reclaim areas disturbed by surface facilities and land leveling, and four to six years to reclaim the waste disposal pile to a grass dominated plant community. A more complete discussion of reclamation is contained in Chapter IV, Surface Reclamation.

Returning the chaining to existing conditions or the pinyon-juniper stands to a subclimax community could be done within a few years after reclamation. The return of the rolling loam and foothills swale range sites to a natural community would take approximately 20 years due to the growth of shrubs.

The areas can be reclaimed by either introduced or native species. If they are reclaimed with introduced species, it would take the vegetation longer to return to the native plant community.

In the rolling loam or foothills swale range sites, a return to the natural or climax community would be desired. In the chained areas, a return to the existing conditions may be desired. In the pinyon-juniper sites, a return to a subclimax grassy community or a climax community may be desired.

The waste disposal piles must be covered sufficiently with topsoil in order for them to support a native plant community. If they are not covered, a salt desert shrub community with low productivity may develop. Although returning the land to its existing vegetative productivity is committed mitigation, this may be a problem on the C-11 Tract.

While the loss of these acres does not represent a significant loss to vegetation as a whole in the White River Resource Area, it may have a significant impact on the use of vegetation by other resources in the immediate area (see Chapter IV, Wildlife, Grazing and Forestry sections).

### C-11 and C-18 Alternatives

The qualitative impacts described in the Combined Alternative narrative section are also applicable to both the C-11 and C-18 alternatives. Table IV-11 differentiates the quantity of range sites disturbed by each development scenario and by alternative.

## Threatened and Endangered Plants

None of the alternatives would significantly impact threatened, endangered or rare plants. However, the loss of undiscovered threatened, endangered or sensitive plant populations would be a significant impact resulting in the loss of important ecological and biological data. There is a probability of disruption or impact to the three known sites of *Astragalus lutosus* within the tract boundaries. *Astragalus lutosus* is currently under review for possible inclusion in the USFWS List of Threatened and Endangered Plant Species.

## Grazing

Surface disturbance would remove forage available for livestock use. The amount, longevity, and type of surface disturbance resulting from the development scenarios would impact grazing to a variable degree. Table IV-12 summarizes the quantity of AUMs impacted by tract and development scenario based on range site disturbances identified in Table IV-11.

### No Action Alternative

Under this alternative, up to 1,500 AUMs of forage could be temporarily lost due to coal mining, oil and gas drilling, oil shale development on Tracts C-a and C-b, and sodium mining. This is only one percent of the AUMs in the White River Resource Area and should not be significant.

Sodium leasing and oil and gas drilling would be the only actions affecting the Square S Allotment. The temporary loss of approximately 15 to 20 AUMs caused by this disturbance should not significantly affect the allotment.

TABLE IV-11
ACRES OF RANGE SITE DISTURBED FOR
DEVELOPMENT ACTIVITIES BY TRACT AND DEVELOPMENT SCENARIO

| | Surface Facilities | | Waste Disposal | | Land Leveling | | Totals | |
|---|---|---|---|---|---|---|---|---|
| | C-11 | C-18 | C-11 | C-18 | C-11 | C-18 | C-11 | C-18 |
| Direct Mining | | | | | | | | |
| Chained pinyon-juniper | 400 | 400 | 300 | 100 | | | 700 | 500 |
| Foothills Swale | | | 500 | 100 | | | 500 | 100 |
| Rolling Loam | | | 200 | 800 | | | 200 | 800 |
| Total | 400 | 400 | 1,000 | 1,000 | | | 1,400 | 1,400 |
| Mine Assisted In-Situ | | | | | | | | |
| Chained pinyon-juniper | 200 | 200 | 500 | 300 | | | 700 | 500 |
| Foothills Swale | | | 500 | 100 | | | 500 | 100 |
| Rolling Loam | | | | 600 | | | | 600 |
| Total | 200 | 200 | 1,000 | 1,000 | | | 1,200 | 1,200 |
| True In-Situ | | | | | | | | |
| Chained pinyon-juniper | 200 | 200 | | | 500 | 300 | 700 | 500 |
| Foothills Swale | | | | | 550 | 100 | 550 | 100 |
| Rolling Loam | | | | | 1,050 | 1,700 | 1,050 | 1,700 |
| Mountain pinyon-juniper | | | | | 900 | 800 | 900 | 800 |
| Rocky pinyon-juniper | | | | | | 100 | | 100 |
| Total | 200 | 200 | | | 3,000 | 3,000 | 3,200 | 3,200 |

TABLE IV-12
AUMS OF FORAGE IMPACTED BY TRACT AND
DEVELOPMENT SCENARIO

| | Surface 1/ Facilities | | Waste 2/ Disposal | | Land 3/ Leveling | | Totals | |
|---|---|---|---|---|---|---|---|---|
| | C-11 | C-18 | C-11 | C-18 | C-11 | C-18 | C-11 | C-18 |
| No Action 4/ | -- | -- | -- | -- | -- | -- | -- | -- |
| Direct Mining | 100 | 100 | 140 | 125 | | | 240 | 225 |
| Mine Assisted In-Situ | 50 | 50 | 170 | 140 | | | 220 | 190 |
| True In-Situ | 50 | 50 | | | 375 | 375 | 425 | 425 |

1/ These AUMs would be lost for the entire life of the mine.

2/ The majority of these AUMs would be lost for the first 15 years of mine life.

3/ These losses in AUMs would occur over the entire life of the mine, however, only 75 AUMs in each tract would be lost at one time.

4/ Assumes no additional tract leasing and consequently no further impacts to the existing situation as discussed under the No Action Alternative.

### Combined Alternative

The Combined Alternative includes the total impacts that will occur if both tracts are developed. Each tract could have a different development scenario.

The worst case situation for livestock grazing under the Combined Alternative would be direct mining and surface retorting on both tracts. Approximately 465 AUMs representing 11 percent of the allotment's grazing capacity would be affected. This would amount to a loss of approximately 15 days of spring use from pastures B and F (where the operator would be required to obtain forage for livestock elsewhere). This reduction in spring use is important since it occurs when the operator needs to move livestock off his fields and onto the allotment. This is necessary to maintain livestock health and to begin hay production on these fields. A reduction in spring use also conflicts with the AMP objective to continue spring livestock use to improve wildlife habitat conditions. This situation would continue for the first 15 years of mine operation. After 15 years, when a majority of the waste disposal piles are reclaimed, a total of 200 AUMs would remain unavailable in pastures B and F due to surface facility disturbances on the two tracts. This represents a five percent reduction in the allotment's grazing capacity and a loss of six to seven days of spring use from pastures B and F. Under this method, the land should return to its productive potential after the life of the mine.

The minimum impact situation for livestock grazing under the combined leasing alternative would be from true in-situ development on both tracts. A total of approximately 850 AUMs would be affected, however, only 250 AUMs representing six percent of the allotment would be lost at any one time from land leveling and surface facilities. This would result in a loss of approximately eight days of spring use from pastures B and F. After the first 15 years of mine life, the loss of 250 AUMs would be more than compensated for by improved forage conditions due to reclamation and other range improvement practices in the B and F pastures. Under the true in-situ scenario, forage production would probably be increased over the potential productivity levels during the first 30 to 40 years immediately following the life of the mine. This is because pinyon-juniper stands considered too steep and rocky for vegetative manipulation would be reclaimed to a grass dominated site. However, over the long-term (75 to 150 years) these stands would revert back to pinyon-juniper woodlands and original productive potential.

However, the AUM losses discussed in the worst case and minimum impact situations above could be off-set through timely implementation of range improvement projects by industry in addition to reclamation of disturbed sites.

All three development scenarios would have impacts on certain range projects also. The most important impacts would involve a developed well and pipeline system, and a spring in the B and F pastures, which provide the bulk of the water to these pastures. All development scenarios would lower the water table, thus reducing the amount of water provided by these facilities. These effects would be both short-term and long-term although the water table would probably return 10 or more years after mine shut down. Due to committed mitigation, any water lost from these facilities would have to be replaced from some other source (Environmental Stipulations of the Lease, Section 11, Protection of the Environment: Additional Stipulations; and Section 12, Operations on the Leased Lands: Water Rights).

The only other potentially significant impact to a range improvement would be disturbance to the 1,200 acres of pinyon-juniper chaining on the tracts. However, these would be reclaimed and there should not be a long-term effect. Productive potential of vegetation on this allotment may not be achieved in the short-term as planned due to interference from surface disturbing activities.

Increased human populations would cause livestock problems similar to those described in Chapter IV, Wildlife, Secondary Off-tract Impacts.

### C-18 Alternative

The impacts from this alternative would be similar to those of the combined alternative, but quantitatively less. Depending on development scenario, approximately 125 to 225 AUMs of forage could be lost. This is approximately half the impact of the Combined Alternative and 0 to 15 AUMs less than what would be lost under the C-11 Alternative. Spring use on pasture B would be reduced by approximately four to seven days. In the long-term, the potential for increasing AUMs from true in-situ type reclamation would be less than for the Combined Alternative.

The impacts on the well would be less than in the Combined Alternative. Only 500 acres of chaining have the potential for being temporarily disturbed instead of the 1,200 acres under the Combined Alternative.

### C-11 Alternative

The consequences of this alternative would be the same as the C-18 Alternative with the following

exceptions. Depending on the development scenario, 125 to 240 AUMs of forage would be lost, or 0 to 15 AUMs more than the C-18 Alternative. Forage and grazing use would be lost from pasture F. Approximately 700 acres of chaining have the potential for being temporarily disturbed instead of the 500 acres under the C-18 Alternative.

### Forestry

The primary environmental consequence to pinyon-juniper woodlands resulting from additional oil shale leasing would be the loss of an undetermined number of acres which would be in a nonproductive woodland status for an extended period of time until successful reclamation occurs.

The total number of woodland acres lost will depend on the exact location of developments, including permanent surface facilities, surface waste disposal areas, and land leveling operations.

Under the No Action Alternative, the loss of woodland acres would continue in the present trend due to developments associated with existing oil shale leases, oil and gas activity and support facilities. Pending sodium Preference Right Lease Applications (PRLAs), which are adjacent to or nearby areas under oil shale lease consideration, if approved, would accelerate the loss of woodland acres. The total number of woodland acres lost depends on the exact location and scale of developments.

Due to the slow regeneration and growing characteristics of both pinyon and juniper, the area may not return to a productive status for 100 to 150 years or longer depending upon the proximity of the closest seed source if reforestation is left to natural regeneration. However, if pinyon and juniper seedlings are properly planted at the time of reclamation, the return to a productive woodland status could be accomplished in 50 to 75 years or sooner depending on the quality of the site (Zarr 1977).

The worst case effects on pinyon-juniper woodlands, from the development alternatives are shown in Table IV-13. This table shows the maximum potential losses to pinyon-juniper woodlands by alternative and development scenario. These acreages are considered maximums, actual losses would probably be less since it is unlikely that all surface disturbance would occur on existing pinyon-juniper woodlands.

The true in-situ mining method poses the highest potential losses to woodlands since more surface disturbance would occur. The maximum potential losses from this method involve the majority of woodland acres within each tract boundary.

Such large scale elimination of woodlands would result in long-term changes in the appearance of the landscape. Revegetation of disturbed woodland areas would reestablish permanent vegetation of a quality which will support fauna of the same kinds and in the same numbers as those existing before disturbance (Environmental Stipulations of the lease, Sections 4 and 11). This is considered to be a difficult task due to the time factor involved in reestablishing pinyon-juniper woodlands.

From a forest resource management point of view, impacts from disturbances resulting from leasing of additional oil shale tracts is not considered serious for any of the designated alternatives or methods of mining. Despite the potential for extensive clearing of pinyon-juniper woodlands, the productivity of these forest lands on both tracts is considered low due to overall inadequate volumes for commercial interest. Therefore, no serious adverse impacts to forest resource management are anticipated.

## WILDLIFE

This section has been organized using three major categories: Terrestrial, Aquatic, and Threatened and Endangered Species. Described impacts are applicable to each of the three development alternatives unless addressed as tract-specific. Quantitative estimates have been identified where applicable.

The No Action Alternative would not result in impacts to the wildlife resouce from additional prototype leasing. However, loss of wildlife habitat and animal population declines would continue from ongoing energy development projects. Approximately 36,000 acres of wildlife habitat would be impacted. This correlates to a mule deer carrying capacity or population decline of approximately 2,000 animals. Water requirements for project development would impact aquatic environments and decrease available water for wildlife use and consumption. Increases in local human populations would provide major primary and secondary impacts to the wildlife resource.

### Terrestrial

Important adverse impacts to terrestrial animal life occur as a result of (1) on-tract physical destruction or alteration of habitat, (2) human encroachment on habitat, (3) direct mortality to wild-

TABLE IV-13
MAXIMUM POTENTIAL ACREAGE LOSS TO PINYON-JUNIPER WOODLANDS
BY ALTERNATIVE AND DEVELOPMENT SCENARIO

| | Direct Mining and Surface Retorting | Mine Assisted In-Situ | True In-Situ |
|---|---|---|---|
| No Action | --- | --- | --- |
| C-11 | 1,400 | 1,200 | 2,300 |
| C-18 | 1,400 | 1,200 | 2,500 |
| Combined * | Minimum 2,400 | Maximum 4,800 | |

* The combined alternative has nine potential variables. The minimum and maximum disturbance acreages have been calculated to identify the range of potential occurrence.

TABLE IV-14
TOTAL SHORT-TERM ESTIMATES OF REDUCTION IN MULE DEER CARRYING CAPACITY FROM BLM-DOW POPULATION OBJECTIVES IN GAME MANAGEMENT UNIT 22 BY ALTERNATIVE AND DEVELOPMENT SCENARIO

| Alternative | Carrying Capacity Decline by Development Scenario (Number) | | | | | |
|---|---|---|---|---|---|---|
| | Direct Mining and Surface Retorting | | Mine Assisted In-Situ | | True In-Situ | |
| | Low | High | Low | High | Low | High |
| No Action 1/ | -- | -- | -- | -- | -- | -- |
| C-11 | 120 | 168 | 88 | 138 | 150 | 321 |
| C-18 | 85 | 119 | 63 | 98 | 107 | 228 |
| Combined | Variable from 151-549 | | | | | |

Note: Estimates include habitat destruction and human encroachment impacts. Low estimates are based on assumptions that: (1) a maximum of 200 acres of surface disturbance would occur at any one time, and (2) rehabilitated areas reestablish into productive wildlife habitat within one year. High estimates are based on assumptions that: (1) approximately 60 percent of the total projected disturbance (Table IV-7) would be in an unproductive condition for wildlife at any one time, and (2) rehabilitated areas would require 10 to 15 years for reestablishment into productive wildlife habitat. Human encroachment impacts are based on a 0.1 mile zone around the disturbed areas. Lyon (1979) describes methodology for determining loss of effective habitat.

1/ Assumes no additional tract leasing and consequently no further impacts to the existing situation.

life, and (4) secondary off-tract impacts. These impacts will be discussed separately below.

### On-Tract Physical Destruction or Alteration of Habitat

The physical destruction or alteration of habitat particularly from large-scale operations is one of the most crucial impacts to the wildlife resource. Habitat destruction or alteration occurs mainly during road construction activities, establishment of surface mine facilities, development of overburden and spent shale piles, construction of product transportation systems, and placement of utility corridors.

The estimated quantity of habitat destroyed or altered for each alternative and development scenario is summarized in Table IV-7. Duration of habitat disturbance is variable and can be separated into permanent and temporary categories. Permanent indicates that the habitat would be disturbed for the entire mine life and would not be available for wildlife use until reclaimed after mine shut down (e.g., surface mine facilities). Temporary disturbances would be reclaimed within a shorter time period and prior to mine abandonment (e.g., pipeline corridors, spent shale piles).

Leasing of Tract C-11 would impact mule deer critical winter range to a greater extent than leasing Tract C-18. Up to 4.9 percent of the critical winter range on public land in the Piceance Basin could be affected by leasing Tract C-11. Leasing Tract C-18 could impact up to .004 percent of the Basin's critical winter range. Leasing of Tract C-11 would result in the additional impact of subdividing one large critical winter range unit into two separate, smaller units. This impact is difficult to assess without site-specific information on mule deer use of the area, and knowledge of facility type and placement. However, the division of this critical winter range is not expected to preclude animal use from either of these smaller units. The major resulting impact of leasing Tract C-11 is predicted to be direct habitat loss and displacement of deer into adjacent unimpacted areas.

Disturbance of terrestrial habitat reduces the quantity of vegetation available for wildlife consumption. Forage loss would be most deleterious to mule deer since preferred deciduous shrub production is considered a limiting factor regulating herd size in Piceance Basin. Total short-term projected declines in mule deer carrying capacity from loss of terrestrial habitat for each alternative and development scenario are presented in Tables IV-14 and IV-15.

Ranking of scenarios over the long-term from greatest to least impactive based on the total reduction in carrying capacity is as follows: direct mining, mine assisted in-situ, and true in-situ. However, scenario ranking over the short-term as shown in Tables IV-14 and IV-15 based on time-specific factors from greatest to least impactive is as follows: true in-situ, mine assisted in-situ, and direct mining. The reason for the difference in ranking is due to a possible decline in productivity of vegetation on spent shale piles over the long-term as described in Chapter IV, Surface. Reclamation and Solid Waste Disposal. For wildlife impact comparison by scenario, the long-term ranking is most realistic and applicable.

Cover utilized by wildlife for reproduction, escape and protection from adverse weather conditions would also be destroyed. Pinyon-juniper provides thermal cover to mule deer during inclement weather. Pinyon-juniper cover on this portion of winter range is important since the highest deer concentrations are present on these areas during periods of most severe weather conditions.

A potential impact of presently undetermined importance is the intake of trace metals by ruminent herbivores in vegetation growing on processed shale. The consumption of molybdenum is the main potential problem. It has been shown that cattle can acquire molybdenosis if the right combination of copper, sulfates, and molybdenum are injested over a period of time. The effect on deer is essentially unknown.

Present reclamation technology is unproven or inadequate in several categories when replacing wildlife habitat of similar type which is equal in quantity and quality to that destroyed or damaged. Methodology for revegetating spent shale piles on a large scale basis is in the speculative phase. Surface disturbance has been successfully revegetated in the short-term with grass and forbs, but to a lesser degree with preferred browse species and pinyon-juniper cover. Establishment of grass and forbs can increase site productivity and provide additional forage for big game use during spring and fall seasons. However, this forage becomes unavailable during the winter when sufficient snow accumulation occurs. Successful establishment of browse stands may require 10 to 20 years after initial planting. Seventy-five to 150 years may be required before reestablishment of pinyon-juniper to conditions where adequate winter cover is provided.

Reclamation of disturbed sites replaces vegetation, but would not adequately compensate entirely for the forage production lost over the period of disturbance. Implementation of habitat improvement projects in addition to site reclamation is necessary to mitigate forage loss and maintain present carrying capacities of the habitat for wildlife use. Vegeta-

tion monitoring is necessary to ensure that forage production of equal quantity and quality is achieved from mitigation efforts.

### Human Encroachment On Habitat

The effects of human encroachment on wildlife are variable depending on the type and quantity of encroachment, the tolerance of a species to encroachment, and the time of year.

A significant increase in vehicular traffic is necessary to transport mineral products and employees (see Chapter IV, Transportation). On-tract development and improvement of road systems would increase local disturbance to wildlife. Intense disturbance from construction activities would also affect wildlife.

If on-tract housing is permitted, additional intensive levels of encroachment would impact the wildlife resource. This would especially be true if no after-hours restrictions are placed on residents. Such encroachment would occur from employees who participate in outdoor recreational activities such as four-wheel driving and snowmobiling, and greatly increases the number and opportunity for people/wildlife encounters. Illegal camping of temporary or short-term employees would promote similar adverse impacts.

Wildlife species respond differently to human disturbance. Disturbance-tolerant species such as passerine birds, mourning dove and cottontail would probably adjust to increased encroachment and would not be significantly impacted. Disturbance-intolerant species such as mountain lion and elk would not adjust and would disperse from the tracts into adjacent, less-impacted habitats.

The season of year when disturbance occurs would also influence wildlife response to encroachment. Raptors tolerate human encroachment to a certain degree except during territorial establishment and egg laying periods of nesting. The golden eagle nest on Tract C-11 would possibly be abandoned if additional encroachment occurs along County Road 24. The seasonal use stipulations and area of no surface occupancy would minimize adverse impacts to this nest from mine associated activities. Mine related activity in close proximity to undiscovered raptor nests, particularly the tree nesting accipiters and owls, would prove detrimental to local raptor productivity and populations. This could be an impact of major concern since two of the accipiter species found here, the sharp-shinned hawk and Cooper's hawk, are on the American Birds Blue List. Species on this list exhibit indications of non-cyclical population declines or range contractions, either locally or on a widespread basis.

On these tracts, the winter season would be the most critical time of year for harmful impacts to mule deer from encroachment. Encounters with people can be a serious matter when deer are concentrated in areas of marginal cover, under physiological stress because of poor forage nutrient content and/or harsh weather, and restricted in mobility by deep snow. The seasonal restriction stipulation, to protect big game critical winter ranges, would be applied as warranted to reduce this impact. It would not eliminate this impact, but would minimize it where management actions apply.

Deer could acclimate to consistent and regular encroachment. However, inconsistent encroachment would affect deer by changing animal behavior, distribution of animals and animal welfare. Mule deer behavior would change when encroachment would prevent traditional unrestricted use of prime feeding, bedding or watering areas. For example, if encroachment from operation of mine facilities occurs only during daylight hours in a prime feeding area, deer may wait until dark to forage there. Displacement of wildlife would occur if encroachment levels exceed their specific tolerance levels or prevent adequate use of crucial portions of the habitat. Animal welfare would be impaired if behavior changes or animal displacement force wildlife to inhabit areas of lesser quality. Animal displacement would concentrate animals together causing local overuse of forage.

Rost and Bailey (1979) and Lyon (1979) both concluded that habitat effectiveness for deer and elk is significantly reduced when an increase in human disturbance occurs. The decline in habitat effectiveness depends upon quantity and location of disturbance, topography, and availability of adequate escape cover. A 0.1 mile buffer zone surrounding the area of surface disturbance was established to determine the size of area impacted and to estimate the number of animals affected. This estimate was added to the predicted animal loss from direct surface disturbance to quantify mule deer impacts.

Effects on the two mule deer seasonal migration routes is presently unknown because the location of facilities is undetermined. Facility placement within or adjacent to the migration routes would not terminate migratory use of the area, but would probably force deer to use adjacent areas of less disturbance.

Wild horses would probably be displaced from their present location to the northeast corner of the Square S Allotment. They would likely remain in this pasture pending availability of adequate water supplies. Inadequate water supplies would force horses onto the North Dry Fork Allotment. Management conflicts would arise since forage has not

been allocated for wild horse use on this allotment and would result in adverse impacts to vegetation condition, and present authorized use by livestock and wildlife.

### Direct Mortality to Wildlife

During construction, small mammals and reptiles of limited mobility would be killed. Loss of these prey species, in turn, may impact dependent predator species.

A significant increase in traffic volume correlates to an increase in the number of vehicle/wildlife accidents. Direct mortality from road kills would occur to many wildlife species, but would most seriously affect mule deer. Analysis of road kill information collected by personnel from C-b Tract along the Piceance Creek Road (Rio Blanco County Road 5) indicates vehicle-related deer kills fluctuate annually. The periods of greatest road kill frequency correspond to migratory movement, and the use of roadside forage and hay meadows. This period extends from mid-October to late-November and early-February to late-April. From 1977 to 1981, 435 road kills were counted along County Road 5. This count does not include road kills on Highways 13 and 64. C-b Tract data collected during 1980 and 1981 indicates an average of 7.65 deer killed per 10,000 vehicles on the Piceance Creek Road. This study also indicated that weather conditions and snow depths may have more effect on the number of road kills than volume of traffic.

Table IV-16 summarizes the estimated increase in vehicle-related deer kills from increases in traffic associated with the various alternatives and development scenarios.

The relationship of the mining work force to poaching rates has been clearly demonstrated in northwestern Colorado. Numerous sources report incidents of energy workers shooting deer and other wildlife indiscriminately enroute to and from work. This unquantifiable impact is compounded in areas where field work coincides with periods when wildlife are most active (e.g., dawn and dusk). Establishment of a busing program to transport employees to and from work would reduce the quantity of road kills and poaching incidents.

### Secondary Off-Tract Impacts

The intensity of secondary impacts is directly proportional to population increases in local communities. Chapter III, Social section identifies and describes projected population increases by alternative and development scenario.

Population increases would result in land consumption (and accompanying habitat destruction) for residential, commercial and community (public facilities and services) development. Table IV-6 estimates the acreage of cropland affected by urban expansion and also applies to the quantity of wildlife habitat destroyed by alternative and development scenario. An increased number of domestic animals, especially dogs and cats, commonly accompanies this community growth and would result in direct adverse impacts on wildlife populations and distribution.

Surveys of construction personnel indicate their preference for outdoor recreational activities (see Chapter IV, Recreation). This correlates to a substantial increase in hunting, fishing, poaching and other recreation-related disturbances to wildlife. Of particular importance is snowmobile use on big game winter range; and ORV use, backpacking and camping on mule deer and elk summer ranges.

Increases in consumptive use of wildlife could force the Colorado Division of Wildlife to alter future game and fish management strategies. Adjustments in bag limits, length of seasons and/or number of sportsmen participating may be necessary to prevent over-harvest.

## Aquatic

Water quality and quantity impacts have been described in Chapter IV, Hydrology. It is assumed that a water augmentation plan (Environmental Stipulations of the lease, Section 9, Pollution--Water) would be developed to mitigate water quality and quantity impacts in Yellow and Piceance Creek. If successfully implemented, this would result in insignificant impacts to stream productivity, fisheries, waterfowl, wildlife consumptive use and animal distribution.

Any spring or well flow depletions within the affected area would reduce water quantity available for animal consumption; affect animal distribution (especially important on spring-summer-fall deer range); reduce available riparian vegetation; and affect riparian-dependent wildlife species.

## Threatened and Endangered Species (T/E)

The Biological Assessment review received from the U.S. Fish and Wildlife Service (USFWS) concluded that this action is not expected to affect the black-footed ferret, bald eagle, peregrine falcon, or

TABLE IV-15
MATRIX SUMMARIZING TOTAL SHORT-TERM ESTIMATED REDUCTION IN MULE DEER CARRYING CAPACITY FOR VARIOUS LEASING COMBINATIONS UNDER THE COMBINED ALTERNATIVE

| C-18 Alternative | C-11 Alternative: Direct Mining Low | Direct Mining High | Mine Assisted In-Situ Low | Mine Assisted In-Situ High | True In-Situ Low | True In-Situ High |
|---|---|---|---|---|---|---|
| Direct Mining | 205 | 287 | 173 | 257 | 235 | 440 |
| Mine Assisted In-Situ | 183 | 266 | 151 | 236 | 213 | 419 |
| True In-Situ | 227 | 396 | 195 | 366 | 257 | 549 |

Note: Footnotes from Table IV-14 are identical and applicable here too.

TABLE IV-16
ESTIMATED ANNUAL INCREASE IN VEHICLE-RELATED DEER KILLS 1/

| | Estimated Potential Number of Deer Killed 2/ | | | |
|---|---|---|---|---|
| | 1988 | | 1993 | |
| Alternative | Low | High | Low | High |
| No Action 3/ | -- | -- | -- | -- |
| C-11 | 207 | 287 | 608 | 1,113 |
| C-18 | 111 | 201 | 462 | 969 |
| Combined | 318 | 488 | 1,070 | 2,082 |

1/ Projections based on estimated traffic increase and existing Piceance Creek road kill information.

2/ 1988 = Peak Construction Year, 1993 = Full Production Year, Low = 25,000 bbls/day production, High = 50,000 bbls/day production

3/ Assumes no additional tract leasing and consequently no further impacts to the existing situation.

whooping crane. Due to uncertainties at this time, an accurate estimation of water depletion from the White River, if any, is impossible. The USFWS therefore defers its biological assessment review on the Colorado squawfish and humpback chub until a preliminary development plan or detailed development plan is submitted (for additional information refer to the Review of Biological Assessment - Public Comment Letter 1).

### Summary

Some of the wildlife resource impacts addressed have been described only in narrative terms without an attempt to quantify their significance. This is mainly due to several factors: (1) unavailable methodology for quantification, (2) insufficient data, (3) unknown location of mine site facilities and mining technology to be incorporated.

However, the impacts described in this section will be addressed more specifically with adequate monitoring systems and mitigation developed in the Habitat Management Plan portion of the Detailed Development Plan as required by Section 4(B) of the Oil Shale Lease Environmental Stipulations.

## CULTURAL RESOURCES

The BLM has contracted for a cultural resource study in the Piceance Basin to generate data of area-wide suitability for planning the proposed oil shale development. This study, will analyze known site distribution and location data, existing artifact collections and areas surveyed for representativeness of the oil shale area. A predictive model of sites types, location and distribution will then be constructed and field tested for accuracy (Newkirk et al March 1982). Until this predictive model is completed, existing survey data will be utilized to assess potential environmental consequences to cultural resources.

Direct impacts to both archaeological and historical resources could result from surface disturbing activity. Under the No Action Alternative, the sodium mine, which includes portions of Tract C-18, would create a surface disturbance of up to 177 acres. Since it is not known how much of the actual surface disturbance would be within the C-18 boundary, it is not possible to give an exact figure of cultural sites which could be disturbed but some disturbance can be anticipated.

Surface disturbance and consequently, impacts to cultural sites increase with the leasing of additional tracts for prototype oil shale development. Since both tracts are of equal size, disturbance would be governed by method of development. Table IV-17 shows the number of sites which could be impacted by tract and development method used. Anticipated cultural resources per acre figures have been developed from existing survey data on file in the BLM's White River Resource Area (Conner and Langdon 1981; Weber et al 1977). Since this is only predictive, no estimate of the significance of these sites can be made.

Existing data for cultural resources shows that site density on Tract C-11 is lower than that recorded for Tract C-18. Either direct mining and surface retorting or mine assisted in-situ development would have the lowest amount of surface disturbance. Therefore, either of these development scenarios used on Tract C-11 would have the least amount of adverse impacts on cultural resources. True in-situ development on Tract C-18 would have the greatest impact. Subsidence could result in delayed impacts to cultural resources.

Indirect impacts to cultural resources could also occur. Although vandalism cannot be directly related to the alternatives, it can be considered an indirect adverse impact. Increased access by energy personnel, construction crews and the general public could add to the amount of damage which could be done to archaeological and historic sites.

## PALEONTOLOGY

### Adverse Impacts

During the construction phase, earth disturbing activities could damage or destroy both vertebrate and invertebrate fossils, whose quality, quantity, and significance have been discussed in Chapter III. The direct access by construction/mining personnel and visitors to the fossil resources could lead to fossils being vandalized or illegally removed. Monitoring to control possible theft or vandalism would be difficult.

Surface disturbing activities could also cause an increased erosion rate which would increase the rate of weathering damage to the fossils.

### Beneficial Effects

Some fossils could be unearthed, undamaged during surface disturbing activities, which would

TABLE IV-17
CULTURAL RESOURCES WHICH COULD BE IMPACTED
BY ALTERNATIVE AND DEVELOPMENT SCENARIO

| Alternative | Direct Mining And Surface Retorting | Mine Assisted In-Situ | True In-Situ |
|---|---|---|---|
| No Action | None | None | None |
| C-11 | 8.6 | 8.6 | 25.9 |
| C-18 | 16.7 | 16.7 | 50.0 |
| Combined | 23.3 | 23.3 | 69.8 |

otherwise have gone unnoticed. Salvaging these fossils would increase our knowledge and understanding of them and their environment. However, unmonitored collecting of fossils by the nonscientific community over a period of time would result in a significant loss of research and exhibit material.

## VISUAL RESOURCES

Visual resources in the White River Resource Area are managed to meet the degrees of contrast allowed by the various visual resource management classes.

Both tracts are located in VRM Class IV. This class allows the greatest degree of contrast. No areas requiring special protective measures have been identified. The proposed developments would be consistent with the management of Class IV areas and would meet the allowable degree of contrast requirements by using standard stipulations. While a large amount of landscape alternatives would occur under the development alternatives, the impacts would be insignificant because the tracts are located in areas with low scenic qualities and viewing sensitivies thus allowing for substantial degrees of contrast with the natural landscapes.

## RECREATION

All of the development alternatives would have some adverse effects upon the hunting use of the tract sites, due to direct disturbances by the oil shale operations. In addition, all four of the alternatives (including the No Action Alternative to a lesser degree) would result in some adverse effects to the hunting use of the Piceance Wildlife Unit (22), due to an increased local population. However, the overall effects upon opportunities for outdoor recreation would be small.

### Direct Impacts

The direct effects, caused by construction and operations, include: land disturbance, noise, game habitat loss, increased traffic on previously little traveled roads, construction of new roads, displacement of both game animals and hunters, and an aesthetic depreciation of the immediate area.

Hunter use on the proposed tract sites cannot be quantified. However, it is known that the roads on these sites are used extensively by hunters during the appropriate seasons (see Figure IV-11). If any of the roads were closed due to oil shale activity, it would deny access to hunters. All six of the BLM roads on the two tracts are mainly limited access type of roads. The Yellow Creek Jeep Trail (Rio Blanco County Road 83) is a primary access road and denial of this route to hunters would be a significant impact.

The fact that mule deer and cottontails (the primary game species) would be displaced from the immediate area (see Chapter IV, Wildlife), would be another reason for a decline in hunting opportunities, in the immediate area of the tract sites. However, the effects on hunting opportunities in the Piceance Wildlife Unit would be relatively unnoticeable as a whole.

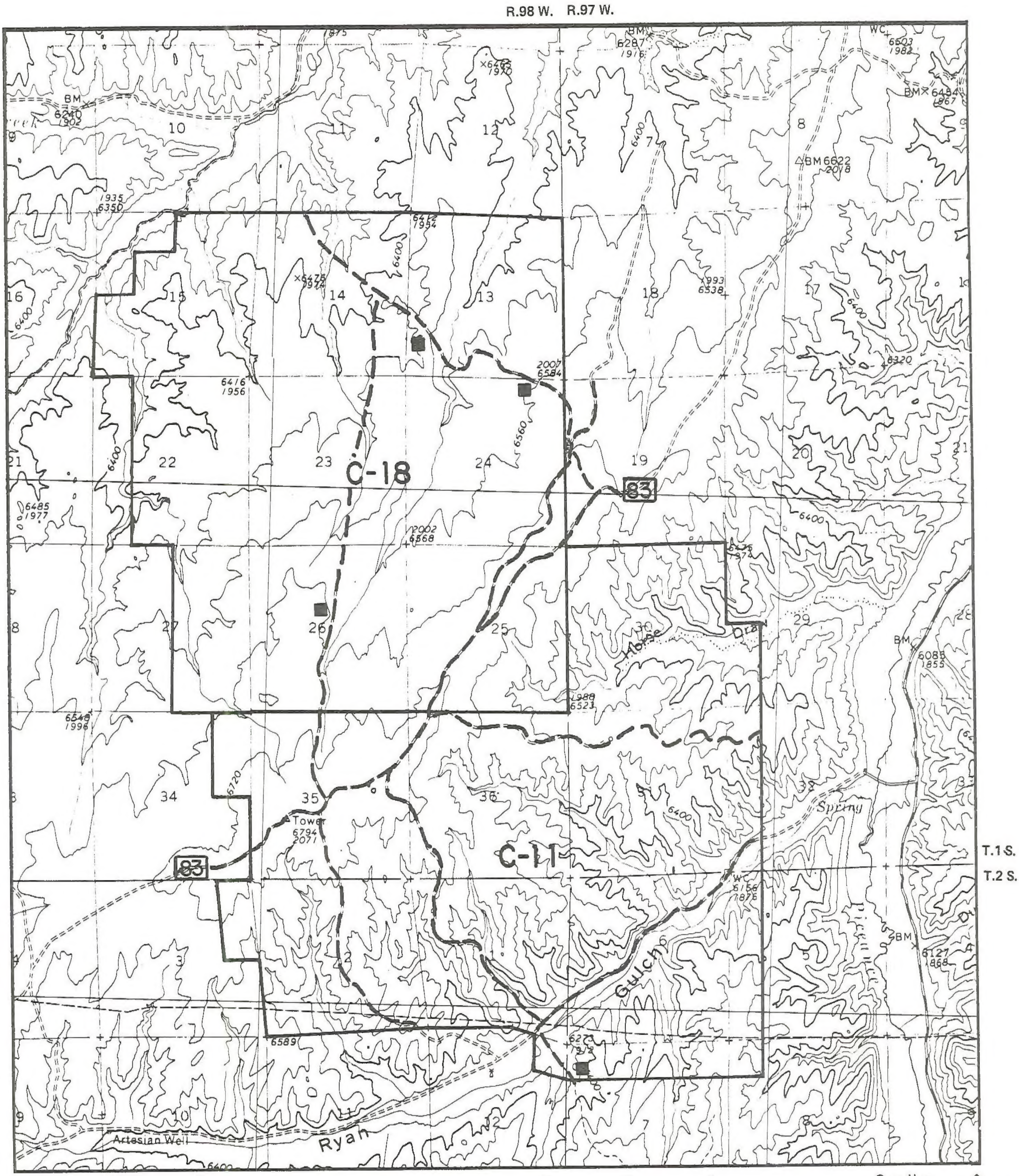
The addition of man-made structures, noise and traffic on the tracts could adversely affect the hunting opportunities in the immediate area. For example, studies have measured the satisfaction derived by deer hunters and found that the three strongest enhancing factors were, in order: naturalness, solitude and marksmanship. Oil shale development would conflict with the first two factors significantly.

The direct impacts to outdoor recreation use (hunting) would be most severe if the Combined Alternative is implemented; next most severe if C-18 is chosen, due to its estimated slightly larger degree of hunting use; and thirdly, the effects of developing C-11. The effects on recreation would be the least from choosing the No Action Alternative.

The mining methods would all have a similar adverse effect on recreation. Even though one may disturb more acreage than another, the overall presence of any of these operations would discourage hunting use near them.

The indirect effects of leasing one or both of these tracts on the hunting use, involves the expected increase in local human populations, especially the influx of a large blue collar population. Surveys of construction and permanent oil workers indicated their most popular recreational activities are fishing, hunting and camping, with lower priority given to indoor activities and spectator sports.

Any human population increase is accompanied by additional hunting pressure. The decided preference of energy-related blue collar workers for this form of recreation causes an additional increase beyond what would normally be expected for that increase in population. In the Gillette, Wyoming coal mining area, for example, the mean number of recreation days per day of hunting season increased over 240 percent from 1971 to 1977 for antelope hunting and by 143 percent for mule deer




0 ½ 1 2 miles

SCALE 1: 50,000

Proposed Prototype Oil Shale Lease Tracts

Hunter Roads

Hunter Camps

**Figure IV-11 Recreation. Hunter Access and Hunter Camps**

hunting. During this same period, the human population increased by only 112 percent for Gillette County (Wyoming Big Game Harvest, Wyoming Game and Fish Department 1979).

If a similar situation occured in this region, the hunter success ratio could adversely change, thus affecting the hunting quality. At that time, the Colorado Division of Wildlife would probably implement a permit system. While this action would restore the quality of the hunting opportunities by limiting the number of hunters, it consequently limits the number of recreational opportunities as demand escalates.

It is impossible to predict the degree of impacts with any accuracy because the Division of Wildlife has no thresholds established for either hunter-density or hunter-success, and because percentage of new hunters to new employees is unpredictable. In addition, the Division of Wildlife does not know where, within the State, hunters that utilize Unit 22 come from.

The indirect impacts of population growth on outdoor recreation opportunities would be more severe the larger the operation(s) due to employment increases. For example, the most impacts would obviously come from the Combined Alternative, as this would create the most employment. The least impacts would result from the No Action Alternative, as the population would increase only 38 percent, versus the 59 percent increase with both tracts, due to other growth in the region. Population effects on recreation would be identical from either the C-18 or C-11 alternatives. The effects of employment on outdoor recreation would also be maximized during the peak construction year of 1988.

Overall, the most significant impact to recreation resulting from the development alternatives would be the possible blockage of hunter access on the Yellow Creek Jeep Trail (County Road 83). The other impacts listed above are estimated to be insignificant, in and of themselves, but add to the cumulative impacts of other developments in the area which increasingly diminish both the quality and quantity of recreation opportunities in this region over time.

# SOCIAL

## Boom Town Social Patterns And Processes, And Their Interaction With Energy Employment Sequences

The social impacts of energy development on communities are similar because the employment patterns underlying them are similar. The severity of impacts and the signficance of the various components impacted for a given community will vary depending upon three sets of factors having to do with characteristics of the present and incoming populations, growth rate, and the size and history of the impacted communities. Communities also differ in their readiness to absorb new population in terms of economic bases, excess capacities of physical facilities, and in-place social services delivery systems. As described in Chapter III, not enough data exist to quantify these, nor is it the function of this document to detail the constantly changing social facilities situation in each case. Communities and counties have other better sources for keeping current their own information for planning purposes. We would more usefully provide better demographic data on the predicted incoming work forces, but unfortunately these are not available. Therefore our best contribution is the most accurate population growth estimates we can provide, with explanations of boom processes and patterns that can be used as guides by individual communities in planning for growth.

In this subsection we shall discuss first, the general form of employment sequences in energy projects as workers enter and affect a community (Figure IV-12). These will vary somewhat, of course, with different types of projects (oil shale, coal, etc.). Second, we shall discuss a general model of social impacts -- the principal social-structural elements, social groups, social and physical conditions, and attitudes and values that would be affected, etc. The model is given in Table IV-18.

In the two subsections following (describing the actual alternatives and their impacts) the term "social impacts" will be assumed to mean the entire set of patterns and processes described in the Table IV-18 model. The estimated population growth curves for the various communities, and the severity of impacts predicted (Tables IV-19 and IV-20) are based upon a population distribution model (described in the section on Economics) which approximates the model given in Figure IV-12. Figures IV-13 to IV-15 demonstrate the similarity to the model for Meeker and Rifle.

TABLE IV-18
SOCIAL IMPACTS: PORTRAIT OF A BOOMTOWN*

| A. Social Structure | Formaliziation | Power/ Influence | Personnel/Facilities Short term | Personnel/Facilities Long term | Defined *** as Social Problem |
|---|---|---|---|---|---|
| Political | Occurs ** | Longtimers -<br>Newcomers + | - | + | |
| Economic | Occurs | Longtimers -<br>Newcomers + | - | + | |
| Educational | Occurs | N/A | - | + | |
| Control/Safety | Occurs | + | - | + | Yes |
| Religious | Occurs | - | - | + | |
| Recreational | Occurs | N/A | - | + | Yes |
| Health-Physical | Occurs | + | - | + | Yes |
| Health-Mental | Occurs | + | - | + | Yes |
| Social Services | Occurs | + | - | + | Yes |

| B. Social Groups | Power | Well Being Physical | Well Being Economic | Well Being Psychological | Interaction Opportunities | Economic Opportunities | Defined as Social Problem |
|---|---|---|---|---|---|---|---|
| Elderly | - | + | + - | + - | + - | N/A | Yes |
| Youth | N/A | + - | + | + - | + | + | Yes |
| Women | | | | | | | |
| Short term | - | + - | + - | - | + - | + - | Yes |
| Long term | + | + - | + - | - | + - | + | |
| Men | + | + | + | + - | + | + | |
| Ranchers | - | 0 | + - | + - | + - | + - | |

| C. Social/Physical Conditions | Short Term | Long Term | Defined as Social Problem |
|---|---|---|---|
| Housing | - | 0 | (short term) Yes |
| Noise/Dirt | - | + - | Yes |
| Traffic | - | - | Yes |
| Unemployment | + (would decrease) | + - | |
| Living Costs | + - | + - | (short term) Yes |
| Quality of Life | + - 0 | + - 0 | |

| D. Attitudes/Values | Short term | Long term |
|---|---|---|
| Energy | + - | + 0 |
| BLM | + - | + - |
| Local Traditions | - | - |
| "World View" | + | + |
| Liberalism | + | + |
| Community Changes | - | + - |

* This table is an attempt to summarize existing literature on what happens to a town in an energy boom

** See text for explanation

*** A social situation only becomes a "social problem" when persons identify it as such. There is public recognition of a need for solutions to these problems but not necessarily agreement on what solutions should be.

\+ Positive Impact  - Negative Impact  0 No Change  N/A Not Applicable

\+ - Positive for some persons/groups, or under some conditions; negative for other persons/groups, or under some other condition

The employment pattern of energy projects consists of a three-pronged segment as shown in Figure IV-12. Construction workers enter in large numbers over a short period of time, followed later by operations workers (miners, etc.). Population increases due to these draw a third group, secondary (non-basic) workers such as salespeople, waitresses, equipment dealers, social workers, etc.

Construction requires many specialized blue collar skills (carpenters, electricians, pipefitters, plumbers) temporarily, and as the various phases start and finish their transiency causes fluctuations in the population curve (wavy line in Figure IV-12), and an accompanying social disruption in the community. Many changes come to be defined as problems by the community (last column, Table IV-18) because in this stage the community (especially if small, stable and isolated) may be unprepared structurally and psychologically, and facilities and services have not been expanded, to meet the demands of increasing population.

Some social problems are created because long-time residents tend to develop negative stereotypes of particularly the construction workers. These local perceptions and the behavior they produce are usually more negative than real differences would imply. The best evidence (see Green River/Hams Fork Final EIS, p. 108) indicates in fact that most incoming workers are from within the region itself (so are not very different). Most construction workers, especially if married, apparently remain as long as work is available, going from job to job within the area, sometimes commuting some distance in order to keep their families in one spot.

Some differences, however, are socially important: construction workers do tend to be younger, more often transient and single, or married but alone with families elsewhere, and come to the scene before a commmunity is able or willing to receive them. They will place somewhat different demands upon the community than will more settled older workers because they have fewer ties and less commitment to it. They are often lonely, with no social bonds, and will be more apt to frequent the bars in spare time to find companionship. Some communities will respond by trying to close ranks to exclude them in much the same way and for much the same reasons communities near military bases may close ranks against a large influx of anonymous, temporary young recruits. Construction workers pose little threat to and have little effect upon most community social structures, but are likely to be perceived as threats to the safety and stability of the community because of the negative stereotypes noted.

Most operations workers are also blue collar but their social impacts are different. High wages, permanency, and the presence of families provide them with more ways of becoming a part of the community. They arrive after the community has made some social and economic adjustments and are less conspicuous and therefore less threatening. They affect such social institutions as schools, churches, civic and government organizations. Finally, secondary workers differ little, if any, from the existing population.

The "boom" period for social impacts is shown in Figure IV-12 as the shaded lag time between construction and non-basic employment. See BLM's Green River/Hams Fork Final EIS, p. 220, for further discussion of boom impacts. If operations workers are much fewer in number than the construction force, the boom will close with some slump in population (about 1990 to 1993 as shown in Figure IV-12) requiring downward adjustments in services, housing, etc., followed finally by a new stabilization at a population larger than the original but smaller than the peak (from 1993-2013 as shown in Figure IV-12).

With full operation, social-structural and social-psychological change will in all probability also slow to an acceptable, comfortable pace because of this population leveling.

Table IV-18 is a general summary of the literature on boom town social impact processes as they affect various social components. Together the items shown represent a graphic picture of an energy boom town. For instance, the fourth element of Part A, Social Structure, Control and Safety, shows that the structure of law enforcement, which is responsible for these, will undergo formalization (better equipment, more formal procedures, more professionally trained personnel will replace less "scientific" equipment, informal procedures, less well trained personnel); that the influence of the police, sheriff, etc, departments in the community will increase; that at first need will outstrip supply of personnel and equipment (short-term negative) but that in the long run law enforcement services will have improved through these changes (long-term positive).

The reader is urged to consider each element line of the model summarized by Table IV-18 for its implications, in order to track the boom change processes.

Thus, Table IV-18 describes the dynamics of social impacts contributing to what is labeled a "boom," and Figure IV-12 diagrams the dynamics of population growth underlying these impacts.

Because (with the exceptions noted below) these patterns are similar for each community and for each alternative, and the time sequences are assumed to be the same, we can now describe two

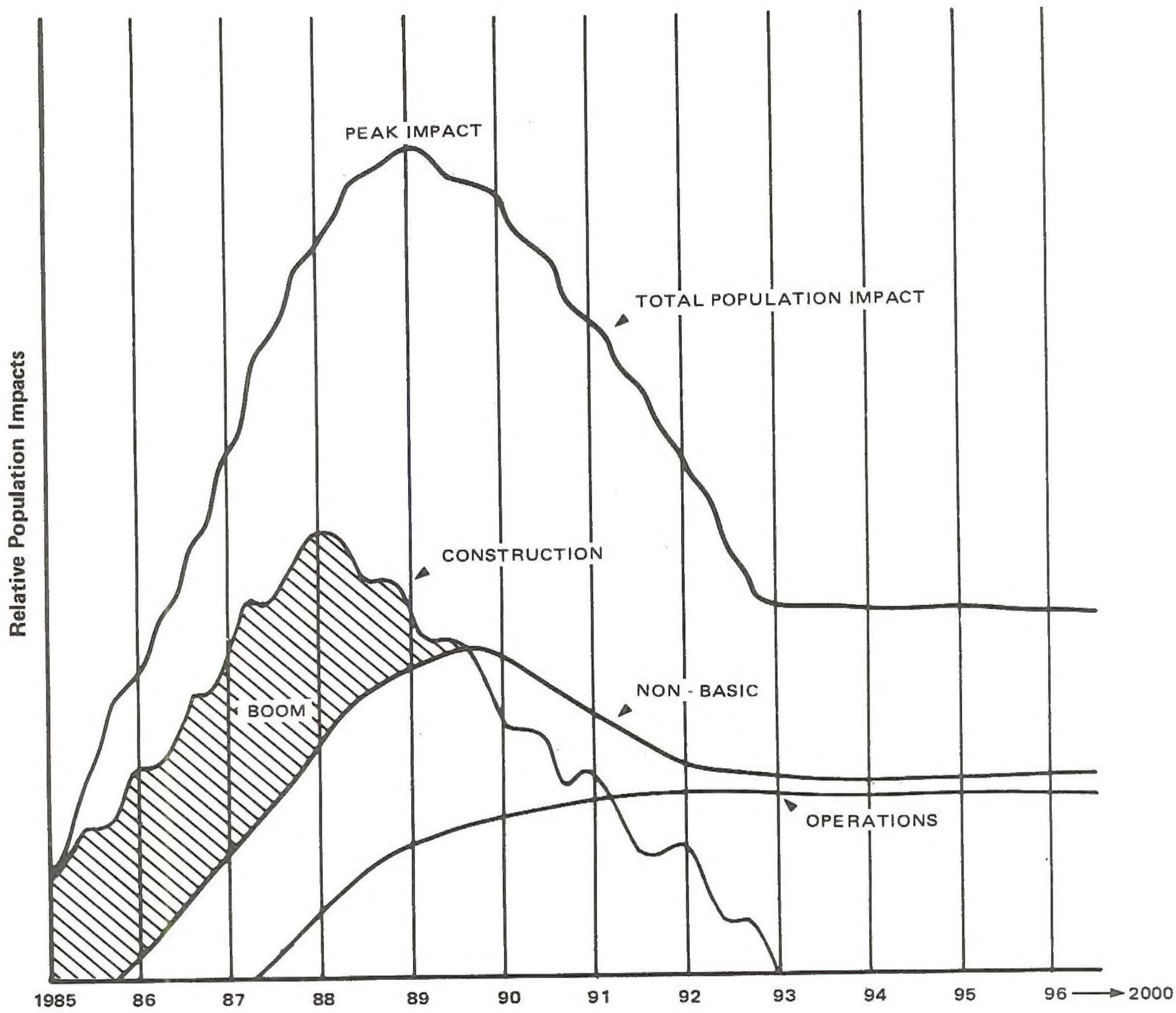



Figure IV-12 Population Impacts From Oil Shale Development by Years

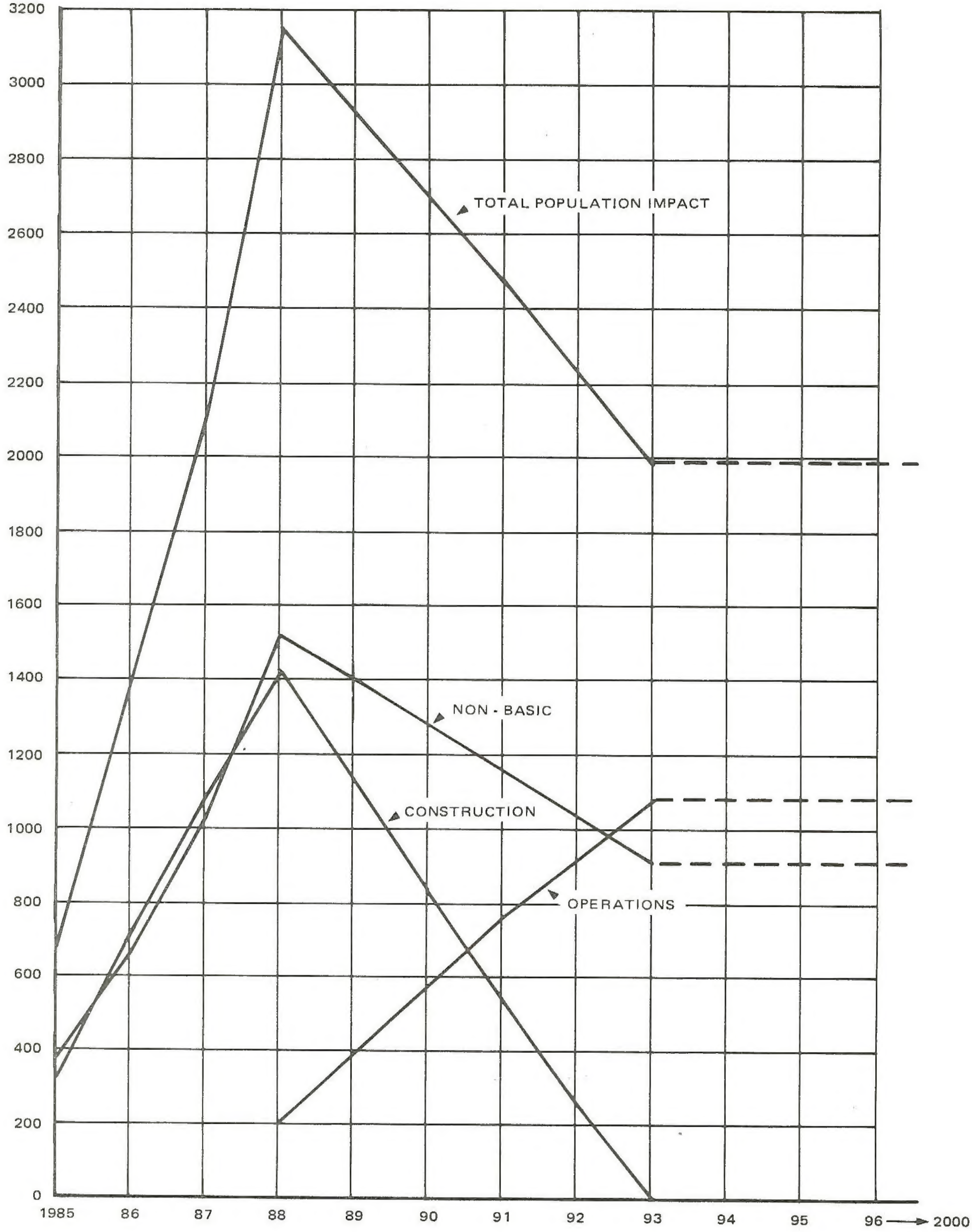



Figure IV-13 Population Impacts by Years, Low Production for Rifle, Colorado - One Tract

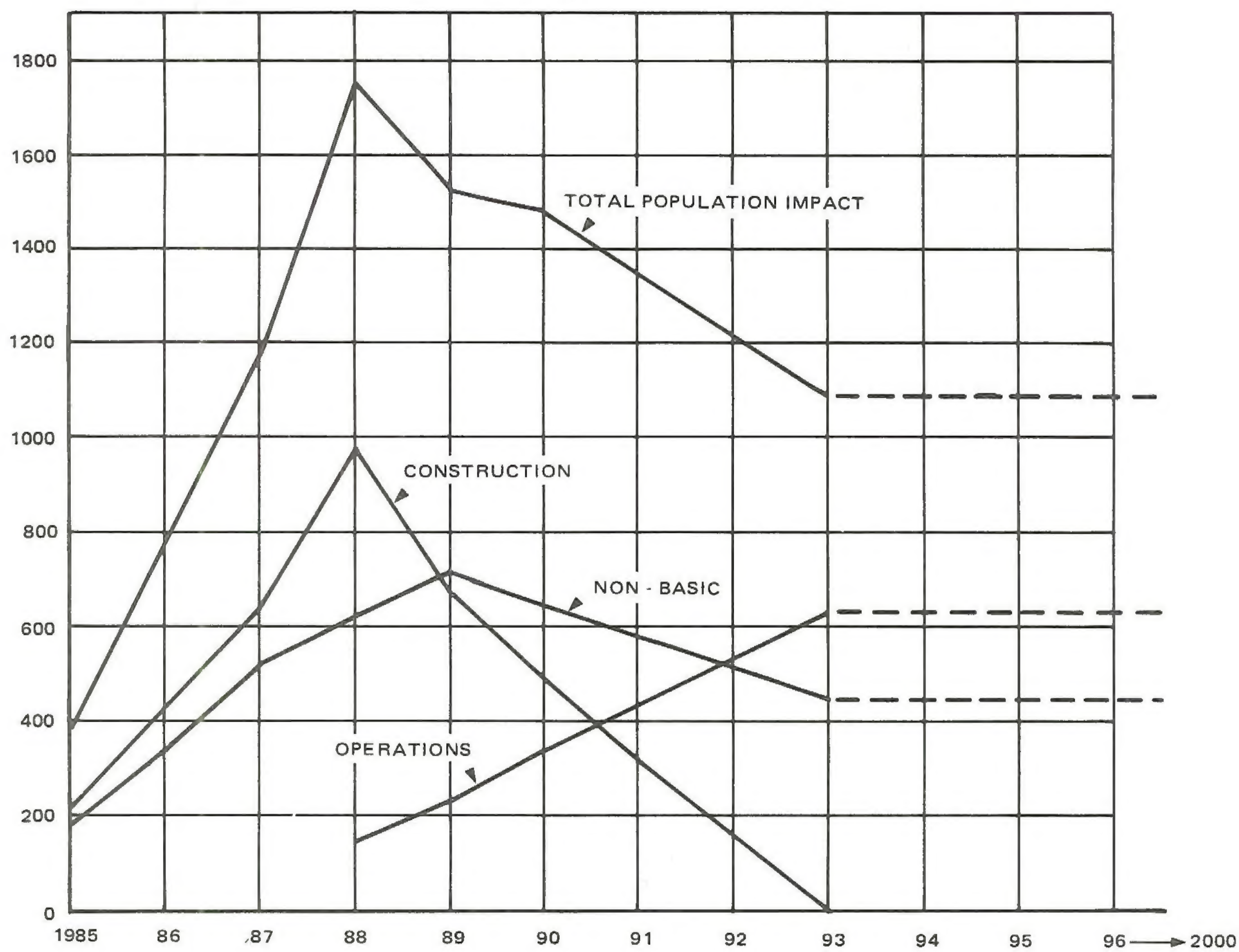



**Figure IV-14 Population Impacts by Years, Low Production for Meeker, Colorado - One Tract**

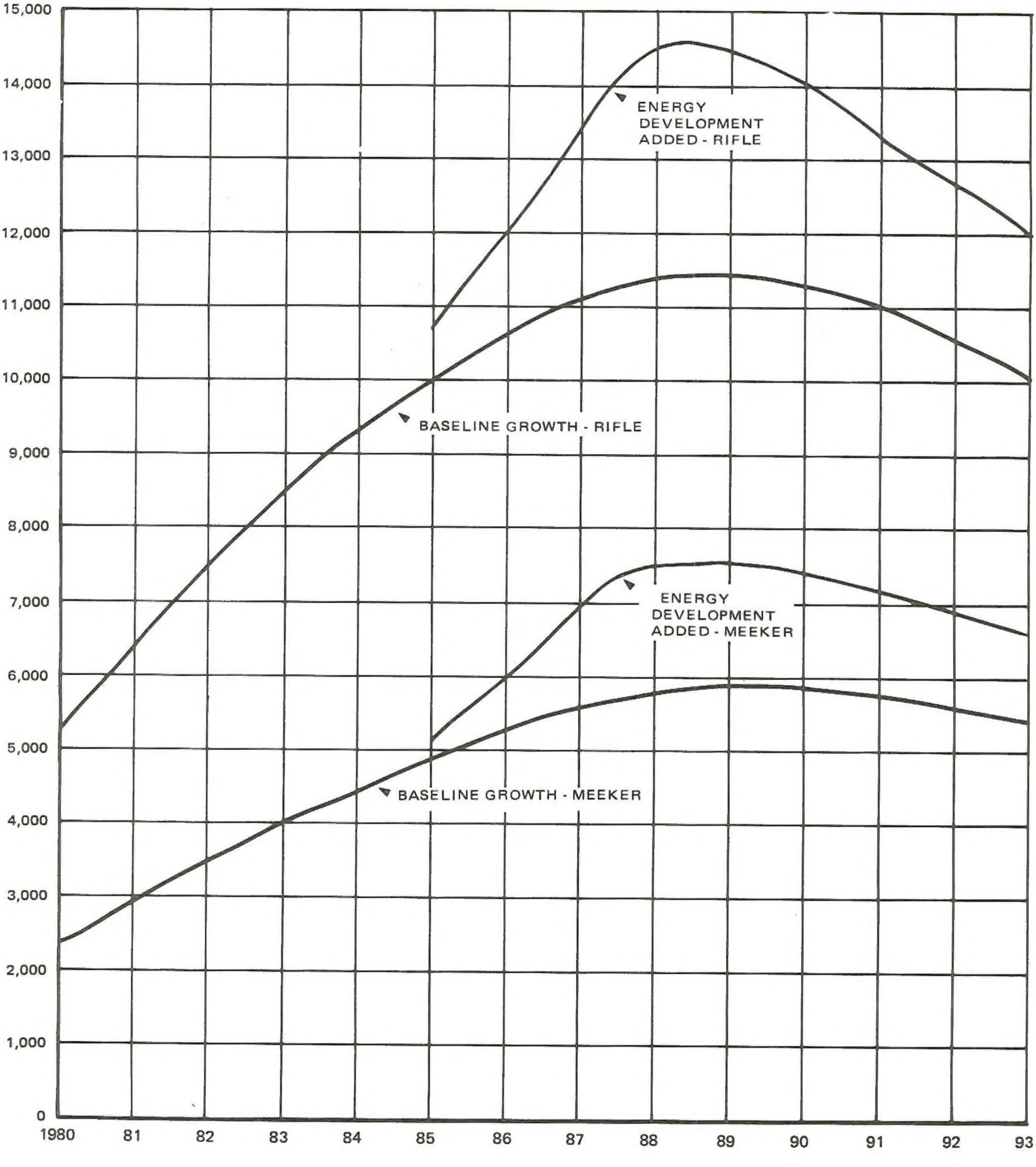



**Figure IV-15 Population Impacts of Oil Shale Development in Baseline Growth 1980 to 1993 for Rifle, Colorado - Low Production Level and Meeker, Colorado - Low Production Level, One Tract**

TABLE IV-19

PERCENT POPULATION IMPACT ABOVE BASELINE GROWTH AT PEAK YEAR EMPLOYMENT (1988) AND AT FULL OPERATION (1993): ALL ALTERNATIVES BY COMMUNITY

(Based on Appendix Tables B-1 Through B-5)

| | | Percent Impacts Above Baseline Growth | | | | | |
|---|---|---|---|---|---|---|---|
| | No Action High & Low | C-18 Low | C-11 Low | C-18 High | C-11 High | Both Tracts Low | Both Tracts High |
| Silt/Newcastle | | | | | | | |
| Peak Impact 1988 | -- | 1.7* | 1.7+** | 2.2 | 2.2+ | 3.5 | 4.5 |
| Full Operation 1993 | -- | 1.2 | 1.2+ | 1.5 | 1.5+ | 2.4 | 2.9 |
| Rifle | | | | | | | |
| Peak Impact 1988 | -- | 27.9 | 27.9+ | 36.5 | 36.5+ | 55.8 | 73.0 |
| Full Operation 1993 | -- | 19.8 | 19.8+ | 19.8 | 19.8+ | 39.6 | 39.7 |
| Parachute/Battlement Mesa | | | | | | | |
| Peak Impact 1988 | -- | .7 | .7+ | .7 | .7+ | 1.3 | 1.3 |
| Full Operation 1993 | -- | .4 | .4+ | .4 | .4+ | .9 | .7 |
| Glenwood Spgs./Carbondale | | | | | | | |
| Peak Impact 1988 | -- | 2.1 | 2.1+ | 2.8 | 2.8 | 4.2 | 5.6 |
| Full Operation 1993 | -- | 1.3 | 1.3+ | 1.6 | 1.6+ | 2.6 | 3.2 |
| Rangely | | | | | | | |
| Peak Impact 1988 | -- | 9.2 | 9.2+ | 10.2 | 10.2+ | 18.4 | 20.5 |
| Full Operation 1993 | -- | 6.0 | 6.0+ | 6.0 | 6.0+ | 12.0 | 12.0 |
| Meeker | | | | | | | |
| Peak Impact 1988 | -- | 30.2 | 30.2+ | 37.2 | 37.2+ | 60.4 | 74.4 |
| Full Operation 1993 | -- | 19.8 | 19.8+ | 21.5 | 21.5+ | 39.6 | 42.9 |
| Grand Junction | | | | | | | |
| Peak Impact 1988 | -- | .1 | .1+ | .1 | .1+ | .3 | .2 |
| Full Operation 1993 | -- | .5 | .5+ | .6 | .6+ | 1.0 | 1.2 |

* All percentages were computed by dividing estimated baseline for the year into total population impact. The full operation percent is assumed to be continued as a permanent population increase for the duration of operations (to 2013). Baseline numbers include the Colony Project projections made before the shutdown of that operation.

** The Multi Minerals Corporation Project is expected to proceed on schedule unless the tract is leased, in which case the project would be absorbed into the C-18 development. Thus, if only C-11 is leased, the Multi Minerals Project would represent an additional impact in population. Where this is likely, percentages have a "+" mark shown.

TABLE IV-20
SEVERITY OF IMPACTS AT PEAK EMPLOYMENT (1988) AND
AT FULL PRODUCTION (1993) ALL COMMUNITIES, ALL ALTERNATIVES

| Significance of Impact | | |
|---|---|---|
| Peak Employment (1988) | Full Production (1993) | Level of Severity of Impact |
| 0-3% | 0-2% | Insignificant |
| 3-6% | 2-5% | Low Severity |
| 6-12% | 5-10% | Moderately severe |
| 12-30% | 10-20% | Severe |
| 30% + | 20% + | Very Severe |

| | Degree of Severity of Impacts by Community 1/ | | | | |
|---|---|---|---|---|---|
| | Insignificant | Low | Moderate | Severe | Very Severe |
| C-18 Only-Low | Silt/New Castle<br>Parachute/B.M.<br>Glenwood/Carb.<br>Grand Junction | None | Rangely | Rifle<br>Meeker | None |
| C-11 Only-Low | Silt/New Castle<br>Parachute/B.M.<br>Glenwood/Carb.<br>Grand Junction | None | Rangely | Rifle<br>Meeker | None |
| C-18 Only-High | Silt/New Castle<br>Parachute/B.M.<br>Glenwood/Carb.<br>Grand Junction | None | Rangely | None | Rifle<br>Meeker |
| C-11 Only-High | Silt/New Castle<br>Parachute/B.M.<br>Glenwood/Carb.<br>Grand Junction | None | Rangely | None | Rifle<br>Meeker |
| Both Tracts-Low | Parachute/B.M.<br>Grand Junction | Silt/New Castle<br>Glenwood/Carb. | None | Rangely | Rifle<br>Meeker |
| Both Tract-High | Parachute/B.M.<br>Grand Junction | Silt/New Castle<br>Glenwood/Carb. | None | Rangely | Rifle<br>Meeker. |

1/ B.M = Battlement Mesa, Carb. = Carbondale.

cases in some detail and compare other communities and other alternatives with them. The seven communities are all undergoing boom development already, as discussed in Chapter III.

## The Alternatives and Impact Processes

For the No Action Alternative, no social impacts would occur beyond those caused by the expected baseline growth as discussed below.

The two communities drawing the largest proportions of new residents from any of the alternatives would be Meeker and Rifle. Figures IV-13 and IV-14 show the estimated population impacts on these for the C-18 Alternative at a 25,000 bbl/day production rate.

These graphs demonstrate that the figures generated by the theoretical population model used for this EIS closely resemble the patterns indicated in Figure IV-12.

In Figure IV-15, the "total" lines from Figure IV-13 and IV-14 are shown as increments above the baseline growth. Baselines are drawn as curves plotted at three points: 1980 (US Census), 1988 and 1993 (BLM projections), representing growth expected from all other sources. For instance, without leasing, in 1988 Rifle would have about 11,300 people; with C-18 (low production rate), this would rise to about 14,500. If both tracts were leased at low level production (not shown; see Table B-3 in Appendix B), the figure would increase to about 17,600. The leasing impacts would obviously be upon an already rapid baseline growth rate. In the case of Rifle, the boom process would be far along in that the characteristics of the small ranching town would already have disappeared -- services and facilities expansion would have occurred, social structures would be largely formalized, power shifts would be taking place, etc. The new "boom" thus would be on top of an on-going rapid growth situation, and would tend to prolong a boom in progress rather than create a new boom.

Meeker's case would be similar except that having started on a smaller population base, the impacts of the "boom" would imply a more drastic earlier stage than would the Rifle case.

The theoretical population distribution model did not place secondary population in Silt or Parachute, nor construction and operations personnel in Glenwood Springs or Grand Junction. With these exceptions, Figures IV-13 and IV-14 typify the patterns of population impacts in the seven affected communities. In all cases Figure IV-15 is illustrative.

Thus, in Figure IV-15 and Table IV-18, we can see the shape of population impact curves, and the forms and processes of changes occurring among the various social components of communities.

## Quality of Life

We now estimate the seriousness of these impacts across the alternatives and communities (Table IV-19). Detailed calculations underlying this summary (and the Figures already discussed) are in Appendix B, Tables B-1 through B-5.

Short-term impacts are given in Table IV-19 as the percentage the peak number is of the baseline population for 1988. Longer term impacts are given as the percent the full operations and non-basic increase are of the baseline population for 1993. For example, the Silt/New Castle baseline population for 1988 is 5,100 persons; the C-18 low production alternative would add an estimated 89 persons by 1988, a percent increase of 1.7. In 1993, the baseline is 4,900, with an estimated 59 persons added by full operation of C-18, or 1.2 percent.

The relationship between the 1988 short-term and 1993 long-term numbers is fixed by the population distribution model, so the severity of impacts is the same for any community for both times, though the meaning of the impact would be different, as discussed below. Table IV-20 summarizes the estimated severity of impacts for each community under each alternative over the life of the operations.

In the short-term (1988 peak), Rifle and Meeker would experience severe quality of life deterioration under the mildest alternative (C-18 low production), and very severe deterioration for the single-tract high production and the Combined Alternatives. Rangely would suffer moderate impacts for all single tract alternatives, and would be severely affected by the Combined Alternatives. Quality of life for Silt and Glenwood would be only mildly affected for the Combined Alternative and would be insignificant for all single tract alternatives. Grand Junction and Parachute would experience no significant social impacts from any alternative.

At full production level, the negative quality of life impacts generally called "boom conditions" would have largely occurred and then declined with the expected slump, but there would be long-term (often permanent) residues that are socially significant. The population increase due to operations would stabilize for the life of the operation (2013). The expanded facilities, more and better social services delivery systems, more formal political processes with a more diverse power structure,

more adequate shopping and entertainment choices, and other features of urbanization would generally remain even after 2013. The small town atmosphere and ethos with their associated psychological comforts for oldtimer citizens would be lost permanently (see Green River-Hams Fork Final EIS, Section 3 for detailed discussion of these).

The community as a whole would readjust to its new size, form and structure, and most newcomers and most oldtimers also would come gradually to feel psychological comfort in the new social context. But some permanent negative effects would have occurred. In spite of inflation of official figures due to better reporting and by more and better services delivery, there would still remain a higher proportion of lives hurt by marital disturbances or divorce, mental stresses, alcoholism, crime; some of the elderly, women, and the young would suffer from loss of social support systems; some ranchers and other oldtimers would have lost social status or financial security due to the power and economic shifts; and so on. Thus for some individuals, loss of life quality would be irretrievable and irreversible.

There are, however, winners: social gains for many, through better jobs and fuller lives, expansion of social choices, a widening of social horizons and opportunities for financial gain. These changes also tend to persist. Both the positives and the negatives are unavoidable.

Thus, while the quality of life for communities and for persons would fluctuate due to rapidity and degree of growth, social component, stage of process, and position in social structure, it is likely that over the long-term, social benefits would outweigh social losses for both.

# ECONOMICS

Leasing of either or both of the tracts would cause significant economic consequences in the region. The consequences would center in Garfield and Rio Blanco Counties, and are expected to most heavily affect the communities of Rifle and Meeker.

They would include front end capital spending requirements for new housing and community facilities, loss of agricultural land to residential and commercial uses, competition for labor disadvantageous to local agriculture and business, and continued or worsened local inflation in housing costs.

A potentially serious effect of the proposed action, when combined with other baseline developments, would be creation of a heavy economic dependence on a single industry -- energy minerals. This dependence would carry the risk of large and sudden fluctuation in employment, income, and population caused by changes in the minerals market or the decisions of mining companies headquartered elsewhere. Maintenance of a viable economic base under these circumstances would be by no means assured, especially in the long-term. Although reasonable baseline projections cannot be made that far in the future, it is highly unlikely that the eventual termination of an energy minerals sector of this magnitude could be replaced by equivalent growth in other basic economic activities.

## Employment and Income

Table IV-21 shows expected employment and income impacts that would result from each alternative.

At the peak of project construction, anticipated to occur in 1988, Garfield County would experience an additional employment growth ranging from eight percent from the development of Tract C-18 in the low scenario to 22 percent if both tracts were developed and the high scenario conditions occurred. Rio Blanco County's smaller employment base would be increased at rates between nine percent and 37 percent under the same sets of conditions. Mesa County is expected to incur less of an impact, with growth rates ranging between zero and one percent, although a number of industries supplying the oil shale projects would expand. A total of anywhere from 2,400 to 8,000 new jobs would be created in the region. Construction and secondary industries would account for practically all of the new jobs during that period, since the operations (mining) phase of the projects would be just starting.

By 1993, with construction work virtually completed and the project(s) operating at a full production level, employment requirements would decline by about one-half. Impacts under the above-mentioned conditions would drop to a range of four percent to 11 percent in Garfield County and three percent to 19 percent in Rio Blanco County. Impacts to Mesa County would remain relatively low. Total jobs created would vary from 1,300 to 4,700, with slightly more in the secondary industries than in mining.

Impacts on wage and salary incomes would parallel those of employment, but would average a couple of percentage points higher because of the above-average wage rates paid in the construction and mining fields. Growth rates would vary from 11 percent in Garfield County and 12 percent in Rio Blanco County for the leasing of Tract C-18 under low scenario conditions to 27 percent and 44 per-

TABLE IV-21
EMPLOYMENT AND INCOME IMPACTS
TOTAL EMPLOYMENT BY INDUSTRY GROUPS AND TOTAL LABOR INCOME (BASELINE PLUS IMPACT)
PROJECTED UNDER EACH ALTERNATIVE

| | Low Scenarios | | | | High Scenarios | | | |
|---|---|---|---|---|---|---|---|---|
| | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts |
| Garfield County | | | | | | | | |
| 1988:Total Employment | 20,800 | 22,900 | 22,500 | 24,600 | 23,600 | 26,300 | 25,900 | 28,700 |
| Construction | 3,400 | 4,400 | 4,400 | 5,400 | 6,500 | 7,800 | 7,800 | 9,100 |
| Mining | 3,100 | 3,200 | 3,000 | 3,100 | 4,100 | 4,200 | 4,000 | 4,200 |
| All Other | 14,300 | 15,300 | 15,100 | 16,100 | 13,000 | 14,300 | 14,100 | 15,400 |
| Total Wage & Salary income (000) | $384,000 | $434,000 | $425,000 | $476,000 | $449,000 | $514,000 | $505,000 | $571,000 |
| 1993:Total Employment | 20,100 | 21,400 | 21,000 | 22,300 | 24,800 | 26,400 | 26,000 | 27,600 |
| Construction | 2,000 | 2,000 | 2,000 | 2,000 | 3,700 | 3,700 | 3,700 | 3,700 |
| Mining | 4,100 | 4,800 | 4,600 | 5,200 | 7,000 | 7,800 | 7,600 | 8,400 |
| All Other | 14,000 | 14,600 | 14,400 | 15,100 | 14,100 | 14,900 | 14,700 | 15,500 |
| Total Wage & Salary income (000) | $362,000 | $392,000 | $382,000 | $412,000 | $491,000 | $528,000 | $519,000 | $556,000 |
| Mesa County | | | | | | | | |
| 1988:Total Employment | 42,700 | 42,800 | 42,800 | 42,800 | 45,800 | 45,800 | 45,800 | 45,900 |
| Construction | 3,800 | 3,800 | 3,800 | 3,800 | 5,100 | 5,100 | 5,100 | 5,100 |
| Mining | 3,100 | 3,100 | 3,100 | 3,100 | 4,000 | 4,000 | 4,000 | 4,000 |
| All Other | 35,800 | 35,900 | 35,900 | 35,900 | 36,700 | 36,700 | 36,700 | 36,800 |
| Total Wage & Salary income (000) | $660,000 | $661,000 | $661,000 | $661,000 | $742,000 | $743,000 | $743,000 | $743,000 |
| 1993:Total Employment | 44,000 | 44,200 | 44,200 | 44,500 | 48,900 | 49,100 | 49,100 | 49,400 |
| Construction | 3,400 | 3,400 | 3,400 | 3,400 | 4,600 | 4,600 | 4,600 | 4,600 |
| Mining | 3,600 | 3,600 | 3,600 | 3,600 | 5,800 | 5,800 | 5,800 | 5,800 |
| All Other | 37,000 | 37,200 | 37,200 | 37,500 | 38,500 | 38,700 | 38,700 | 39,000 |
| Total Wage & Salary income (000) | $683,000 | $686,000 | $686,000 | $689,000 | $808,000 | $812,000 | $812,000 | $815,000 |
| Rio Blanco County | | | | | | | | |
| 1988:Total Employment | 6,700 | 8,000 | 7,300 | 8,600 | 7,500 | 9,200 | 8,600 | 10,300 |
| Construction | 1,600 | 2,300 | 2,300 | 3,000 | 1,900 | 2,800 | 2,800 | 3,700 |
| Mining | 2,100 | 2,200 | 1,800 | 1,900 | 2,400 | 2,500 | 2,100 | 2,200 |
| All Other | 3,000 | 3,500 | 3,200 | 3,700 | 3,200 | 3,900 | 3,700 | 4,400 |
| Total Wage & Salary income (000) | $144,000 | $177,000 | $161,000 | $195,000 | $162,000 | $205,000 | $190,000 | $234,000 |
| 1993:Total Employment | 6,400 | 7,200 | 6,600 | 7,400 | 7,400 | 8,400 | 7,800 | 8,800 |
| Construction | 900 | 900 | 900 | 900 | 900 | 900 | 900 | 900 |
| Mining | 2,500 | 2,900 | 2,500 | 3,000 | 3,100 | 3,700 | 3,300 | 3,900 |
| All Other | 3,000 | 3,400 | 3,200 | 3,500 | 3,400 | 3,800 | 3,600 | 4,000 |
| Total Wage & Other income (000) | $139,000 | $160,000 | $144,000 | $164,000 | $164,000 | $189,000 | $173,000 | $198,000 |

The construction and mining employment groups are shown separately because direct impacts would affect those groups. Indirect impacts would occur in the other industry groups, except in Mesa County where impacts to industries supplying the projects would also be included in the all other category.

TABLE IV-22
NEW HOUSING REQUIREMENTS
ADDITIONAL HOUSING UNITS REQUIRED (BASELINE PLUS IMPACT) UNDER EACH ALTERNATIVE

| | Low Scenarios | | | | High Scenarios | | | |
|---|---|---|---|---|---|---|---|---|
| | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts |
| Garfield County | | | | | | | | |
| Glenwood Springs - Carbondale | | | | | | | | |
| 1988 | 1,200 | 1,330 | 1,320 | 1,450 | 1,200 | 1,370 | 1,370 | 1,540 |
| 1993 | 920 | 1,000 | 990 | 1,080 | 920 | 1,020 | 1,020 | 1,120 |
| New Castle-Silt | | | | | | | | |
| 1988 | 370 | 400 | 390 | 420 | 370 | 420 | 400 | 440 |
| 1993 | 300 | 320 | 300 | 320 | 350 | 370 | 350 | 380 |
| Parachute-Battlement Mesa | | | | | | | | |
| 1988 | 2,700 | 2,730 | 2,720 | 2,740 | 3,580 | 3,610 | 3,600 | 3,630 |
| 1993 | 2,590 | 2,600 | 2,600 | 2,610 | 4,380 | 4,400 | 4,400 | 4,420 |
| Rifle | | | | | | | | |
| 1988 | 2,040 | 3,160 | 2,930 | 4,060 | 2,040 | 3,550 | 3,310 | 4,830 |
| 1993 | 1,570 | 2,300 | 2,070 | 2,810 | 2,450 | 3,390 | 3,150 | 4,100 |
| Mesa County | | | | | | | | |
| Grand Junction | | | | | | | | |
| 1988 | 2,230 | 2,280 | 2,280 | 2,310 | 3,570 | 3,600 | 3,600 | 3,630 |
| 1993 | 2,960 | 3,140 | 3,140 | 3,330 | 5,790 | 6,010 | 6,010 | 6,230 |
| Rio Blanco County | | | | | | | | |
| Meeker | | | | | | | | |
| 1988 | 650 | 1,250 | 930 | 1,550 | 800 | 1,630 | 1,300 | 2,140 |
| 1993 | 540 | 950 | 630 | 1,040 | 800 | 1,330 | 1,000 | 1,520 |
| Rangely | | | | | | | | |
| 1988 | 490 | 630 | 570 | 710 | 790 | 970 | 920 | 1,110 |
| 1993 | 450 | 550 | 490 | 580 | 760 | 870 | 820 | 940 |

Housing requirements shown are for all types, including temporary housing. The 1993 figures show new housing required by growth from 1980, not from 1988.

cent in those two counties, respectively, if both tracts were leased under high scenario conditions.

Requirements for construction workers would far exceed the capacity of the local labor force. However, other major construction projects are expected to increase the construction work force considerably above present levels. It is estimated that about 50 percent of the construction jobs would be filled by in-migrants under the low scenario and from 60 to 70 percent under high scenario conditions. Continued growth that is forecast in Mesa County under high scenario assumptions would produce a tight enough labor market that most new jobs would be filled by newcomers. Not all of the in-migrants would become permanent residents since many of the construction workers would seek jobs elsewhere after completion of the projects.

The end of construction by 1993 would leave a temporary surplus of labor, and no net in-migration would be needed to fill the operations jobs. However, considerable change in types of workers would doubtless occur, with construction workers leaving and miners coming in.

## Population

Population impacts to communities depend on where workers choose to live. This analysis assumes that most workers will locate in Rifle and Meeker. Tables B-1 through B-5 in Appendix B show the expected population impacts.

Impacts to those two communities would be significant under all alternatives in both scenarios and would be extreme if both tracts were leased. In the low scenario, Rifle would grow 19 percent by 1988 if Tract C-18 only were leased (the minimum impact) and 45 percent if both tracts were leased. In the high scenario, corresponding impacts would be 28 percent and 63 percent. Meeker would experience population increases ranging from 12 percent to 25 percent under the same alternatives in the low scenario and from 21 percent to 56 percent in the high scenario. The only other community reaching double digit impact percents would be Rangely, which would expand from 12 to 16 percent by 1988 if both tracts were leased. Again, impacts would lower by 1993 in all communities with the end of construction. Nevertheless, they would still be significant in those three communities, reaching as high as 35 percent in Rifle in the high scenario with both tracts leased (specific impact percents for all communities are shown in Tables IV-25b through IV-25d).

## Housing

Additional housing requirements would be high in several communities during the construction period; however, some of these requirements would be temporary. Because those temporary demands may be handled by mobile home parks and man camps, a better measure of new housing needs is that of the operation work force. Therefore, Table IV-22 shows new housing requirements in both 1988 and 1993, even though those in 1993 are generally lower. It should be emphasized that the table shows new housing requirements: total required housing net of the 1980 housing supply as given by the census. The 1993 figures show new housing required by growth from 1980, not from 1988.

Proportionate impacts appear higher than those for population because of the deduction of current housing vacancies from the No Action Alternative figures. The analysis basically shows that the same communities -- Rifle, Meeker and Rangely -- would be most heavily impacted, especially if both tracts were leased.

## Impacts to Other Resources

### Agriculture

No on-tract impacts would occur to croplands. Between 125 and 465 animal unit months (AUMs) of grazing would be lost if the tracts were leased, depending on the alternative and method of mining (see Chapter IV, Grazing). The resulting annual losses to ranchers and local businesses and taxes would range from $9,000 to $32,000, as shown in Table IV-23.

Secondary impacts, resulting from population growth, would involve conversion of agricultural land to residential and commercial uses. Because it is impossible to anticipate how much of the converted land would be cropland and how much rangeland, a worst case situation is assumed that all would be cropland. Losses of cropland under the different alternatives would vary from 910 to 2,290 acres, in addition to the 6,770 to 10,160 acres that will be converted without the proposed action (see Chapter IV, Agricultural Lands). Using an average value per acre for crops grown in these counties gives the estimated impacts on crop sales shown in Table IV-23.

While the impacts to grazing would exist only during the life of the project and ensuing reclamation period, those resulting from conversion of agri-

cultural land would represent permanent losses to the local area and the nation.

One other potential impact cannot be quantified: competition for labor. High-paying construction and mining jobs tend to draw workers out of other industries, including local trade and service as well as agriculture. The agriculture impact would be small in Rio Blanco County, where little hired labor is used, but would be more serious in Garfield and Mesa Counties. The effect on other local business would be significant in all three counties.

### Wildlife

The local economic value of deer hunting lost (the principal game animal in that area) as a result of habitat destruction and road kills (assuming deer population reaches the habitat capacity - see Chapter IV, Wildlife) would vary from $9,000-$131,000. Little, if any, additional local economic loss would result from reduction of other wildlife because the present animal population exceeds hunting demand. Nonlocal losses would be negligible because of the numerous other hunting locations available in the region and the state.

## Local Government Fiscal Impacts

Rio Blanco County and the impacted communities would benefit from increased revenues as a result of the proposed action. However, they and the other impacted counties would also incur sizable operating and capital costs in order to meet the needs of larger populations and greater business activity. From a capital budgeting standpoint, the costs would outweigh the benefits for most jurisdictions.

Development of oil shale would add to government revenues at all levels. The operations would pay royalties to the federal government, severance taxes to the state government, and property taxes to the county government. Employees and secondary businesses would pay property taxes, sales taxes, and other charges to the municipal and county governments. Portions of the royalties and severance taxes would be returned to the county and municipal governments where the operations are located.

Since the method for determining assessed valuation of oil shale has not been determined, it is impossible to project the impacts of the operations on property taxes. Also, severance taxes cannot be projected because the formula requires data on operating costs to determine taxable revenue. Impacts on both of these would undoubtedly be large.

The federal royalty rate is 12 cents per ton of shale, adjusted downward one cent for each gallon of average oil content less than 30 gallons per ton, and adjusted upward by the ratio of the current wholesale price for crude oil to that in March 1974. Additional royalties would be charged for nahcolite and dawsonite produced, based on price, but no market prices have yet been established for those minerals. If the royalty were to be applied to production in October 1982, for example, the Producer's Price (wholesale price) Index for September 1982 of 718.8, divided by the March 1974 index of 201.7, would result in an escalation factor of 3.564 being applied to each of the royalty rate amounts. This would result in a basic royalty rate on the October 1982 production of 42.8 cents per ton of oil shale processed either through mining or in-situ methods, with a reduction or addition of 3.6 cents per ton for each gallon of shale oil above or below 30 gal/ton, and a minimum royalty rate of 14.3 cents per ton. Assuming production rates of 25,000 to 100,000 bbl/day, oil content of 30 gal/ton, and using the September 1982 price index, total annual royalties would amount to between $5,464,000 and $21,854,000. The State of Colorado receives 50 percent of federal royalties, which would come to $2,732,000 to $10,927,000 and 50 percent of those amounts would be returned to the county of origin, up to a maximum of $800,000. Thus, Rio Blanco County would receive $800,000 in federal royalty revenues under any of the alternatives.

Population and local business growth would add considerably to local residential and commercial property taxes and sales taxes, as shown in Table IV-24. These revenues would accrue to communities, where such growth would take place, while the taxes paid by an operation would go to the county. Rifle and Meeker would benefit the most, with Rangely, the Glenwood Springs-Carbondale area, and Grand Junction also receiving sizable amounts under certain circumstances.

Estimated capital benefits and costs are shown in Tables IV-24a and IV-24b. Definitions of terms and analytical methods are given in notes to the tables. Rifle would be heavily impacted by all but the No Action Alternative, and Meeker by all alternatives. Capital requirements would exceed bonding capacity in Rifle by ratios varying from 2.8 if only C-18 were leased under the low scenario to 5.9 if both tracts were leased under the high scenario. Similar ratios for Meeker in 1988 (when peak population would occur) range from 2.6 for C-18 only, low scenario, to 3.1 for C-11 only and both tracts, high scenario. Impacts of the tracts on Grand Junction's capital budget would be relatively small, but the city would already be adversely impacted by those developments occurring under the No Action Alternative. Rangely alone would be able

to finance all of its needs, mainly because of its existing excess capacity. School districts at Rifle and in Mesa Valley would also have difficulty, since facilities expansion sufficient to meet projected needs might require more than their anticipated bonding capacity. The Meeker school district's needs would also approach its bonding capacity, but Rangely's school district should have fewer problems.

This analysis indicates that Rifle, Meeker, and the Rifle and Mesa Valley school districts would need considerable impact assistance if the proposed developments were to take place, and Grand Junction and the Meeker school district would also have difficulty in meeting their facilities needs.

### Other Economic Impacts

Projected new housing requirements would aggravate the inflation in local land values and housing costs that has already occurred as a result of current developments. In the worst cases, where new housing requirements rise into the 20 plus percent range (see Tables IV-25b through IV-25d), housing costs would almost certainly get a further upward push. In other cases, inflation would be kept from declining locally despite fluctuations in regional and national housing markets. Those groups within the population having low incomes (many trade and service workers) or fixed incomes (most retired people) would be the most severely affected by continued or worsened inflation. The only way these effects could be prevented would be by major and early government efforts to set aside land and provide housing capital.

On the positive side, growth in employment and income would improve local business conditions and increase the variety of available shopping, especially in the smaller communities.

### Summary

Tables IV-25a through IV-25d summarize the economic impacts. Please note that percentage impacts in Table IV-25a are low because they are heavily weighted by Mesa County, the largest but least impacted county. Impacts to individual counties and communities in the other three tables provide a better measure of impact significance.

There is no objective standard for significance of economic impacts. Rather than use arbitrary percentage ranges to define significance levels, this analysis refers to impacts as "moderate", "large", etc. on a judgment basis. With the percentages given, readers should draw their own independent conclusions.

Parachute-Battlement Mesa, Rifle, Meeker, and possibly other communities may be heavily impacted by oil shale and other mineral developments assumed in the No Action Alternative, depending on the course of events. If that happens, even moderate impacts from these alternatives would have serious consequences when community resources are already stretched to the limit.

Leasing Tract C-11 alone would cause sizable economic impacts to Garfield and Rio Blanco Counties, with the largest impacts to Rifle and Meeker. Moderate impacts would be caused to Rangely. These communities would also benefit from increased tax revenues, roughly in proportion to their population impacts.

Leasing Tract C-18 alone would cause a similar pattern of impacts on a lesser scale because the sodium project would be absorbed in any oil shale operation on that tract. Impacts to Rifle and Meeker would still be fairly large.

Leasing both tracts would cause fairly large impacts to Garfield and Rio Blanco Counties and Rangely and major impacts to Rifle and Meeker. In this case, it is unlikely that the increased revenues received by communities would offset the capital and operating costs that would be necessitated by such rapid population growth, and the heavily impacted towns would need large infusions of assistance.

## TRANSPORTATION

### Highways

Assumptions:

1. The majority of employees would use busing between the tract(s) and local communities. An average of 20 persons per bus is estimated.

2. Unless otherwise noted, by 1993 the sodium and alumina minerals shown in the Chapter II Product Transportation table for the direct mining method would be trucked to the railhead at Rifle. No products would be transported in 1988. Trucks would transport 25 tons of minerals, or approximately 7,000 gallons of shale oil per round trip.

3. C-a and C-b Tracts would not truck any of their products.

TABLE IV-23
IMPACTS ON AGRICULTURE
(THOUSAND DOLLARS)

| | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts |
|---|---|---|---|---|
| Impacts on grazing | | | | |
| Low impacts | | | | |
| Ranchers | | $4 | $4 | $8 |
| Local Business & Taxes | | 5 | 5 | 10 |
| High Impacts | | | | |
| Ranchers | | 7 | 7 | 14 |
| Local Business & Taxes | | 9 | 9 | 18 |
| Impacts on crop sales | | | | |
| Low scenarios | | | | |
| Garfield County | $208 | $239 | $239 | $269 |
| Mesa County | 603 | 670 | 670 | 759 |
| Rio Blanco County | 33 | 46 | 46 | 62 |
| High scenarios | | | | |
| Garfield County | 306 | 343 | 343 | 386 |
| Mesa County | 893 | 1,005 | 1,005 | 1,094 |
| Rio Blanco County | 53 | 72 | 72 | 89 |

Note: Low and high impacts result from different assumed mining techniques, not low and high scenarios as used elsewhere in this report.

TABLE IV-24
COMMUNITY REVENUE IMPACTS
ADDITION TO PROPERTY AND SALES TAX REVENUES PROJECTED UNDER EACH ALTERNATIVE
(in thousands of dollars)

| | Low Scenarios | | | High Scenarios | | |
|---|---|---|---|---|---|---|
| | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts |
| Garfield County | | | | | | |
| Glenwood Springs - Carbondale | | | | | | |
| 1988 | $150 | $120 | $260 | $200 | $170 | $370 |
| 1993 | 100 | 70 | 170 | 130 | 100 | 230 |
| New Castle - Silt | | | | | | |
| 1988 | 3 | 1 | 4 | 4 | 2 | 6 |
| 1993 | 1 | * | 2 | 3 | 1 | 4 |
| Parachute-Battlement Mesa | | | | | | |
| 1988 | 1 | 1 | 2 | 2 | 1 | 3 |
| 1993 | 1 | 1 | 2 | 1 | 1 | 2 |
| Rifle | | | | | | |
| 1988 | 720 | 560 | 1,290 | 970 | 810 | 1,790 |
| 1993 | 490 | 340 | 830 | 640 | 480 | 1,110 |
| Mesa County | | | | | | |
| Grand Junction | | | | | | |
| 1988 | 30 | 30 | 50 | 20 | 20 | 40 |
| 1993 | 110 | 110 | 220 | 130 | 130 | 260 |
| Rio Blanco County | | | | | | |
| Meeker | | | | | | |
| 1988 | 380 | 170 | 560 | 520 | 310 | 840 |
| 1993 | 280 | 70 | 340 | 350 | 140 | 490 |
| Rangely | | | | | | |
| 1988 | 100 | 50 | 150 | 140 | 80 | 230 |
| 1993 | 70 | 20 | 90 | 100 | 40 | 130 |

* Less than $500

TABLE IV-24a
CUMULATIVE COMMUNITY BONDING CAPACITY AND CAPITAL REQUIREMENTS
(Thousand dollars)

| | LOW SCENARIO | | | | HIGH SCENARIO | | | |
|---|---|---|---|---|---|---|---|---|
| | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts |
| Rifle | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | $2,400 | $3,400 | $3,200 | $4,000 | $2,400 | $3,700 | $3,500 | $4,600 |
| Capital requirements | 500 | 11,000 | 9,100 | 18,000 | 500 | 14,100 | 12,100 | 24,100 |
| 1993 | | | | | | | | |
| Bonding capacity | 2,100 | 2,800 | 2,600 | 3,200 | 2,700 | 3,600 | 3,400 | 4,100 |
| Capital requirements | 500 | 11,000 | 9,100 | 18,000 | 3,700 | 14,100 | 12,100 | 24,100 |
| Grand Junction | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | 9,300 | 9,300 | 9,300 | 9,300 | 10,100 | 10,200 | 10,200 | 10,200 |
| Capital requirements | 21,700 | 21,900 | 21,900 | 22,000 | 27,200 | 27,300 | 27,300 | 27,400 |
| 1993 | | | | | | | | |
| Bonding capacity | 9,800 | 9,900 | 9,900 | 10,000 | 11,500 | 11,700 | 11,700 | 11,800 |
| Capital requirements | 24,700 | 25,600 | 25,600 | 26,200 | 36,300 | 37,200 | 37,200 | 38,100 |
| Meeker | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | 1,000 | 1,700 | 1,400 | 1,900 | 1,100 | 1,900 | 1,700 | 2,300 |
| Capital requirements | 2,000 | 4,800 | 3,700 | 5,500 | 2,500 | 5,900 | 4,800 | 7,200 |
| 1993 | | | | | | | | |
| Bonding capacity | 900 | 1,500 | 1,200 | 1,500 | 1,100 | 1,700 | 1,500 | 1,900 |
| Capital requirements | 2,000 | 4,800 | 3,700 | 5,500 | 2,500 | 5,900 | 4,800 | 7,200 |
| Rangely | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | 700 | 800 | 800 | 900 | 900 | 1,100 | 1,000 | 1,200 |
| Capital requirements | 0 | 0 | 0 | 0 | 0 | 200 | 100 | 200 |
| 1993 | | | | | | | | |
| Bonding capacity | 700 | 800 | 700 | 800 | 900 | 1,000 | 1,000 | 1,100 |
| Capital requirements | 0 | 0 | 0 | 0 | 0 | 200 | 100 | 200 |

Note: Time and data limitations ruled out a complete fiscal analysis of the impacted jurisdictions. Therefore, the analysis is restricted to the impact on capital budgets, usually the most severe impact accompanying energy development.

Two measures are used: bonding capacity and capital requirements. Bonding capacity is a limit established by the state legislature on the dollar value of general obligation bonds a local jurisdication may have outstanding. It is based on assessed valuation, amounting to approximately 10 percent for communities and 20 percent for school districts. Home rule cities (Rifle and Grand Junction) are not subject to this limit but, since voter resistance increases as more bonds are issued, a similar limit may well apply. General obligation bonds outstanding as of 12/31/80 (the latest published data) were subtracted from gross bonding capacity to obtain the net bonding capacity figures in the table. Additions to school district bonding capacity due to the tracts are not included because of the difficulty of projecting the assessed valuation of oil shale properties.

Capital requirements is an estimate of the investment in capital improvements that would be necessitated by population growth. Complete capital budgeting for the jurisdiction was, of course, impossible. Seven items were estimated for communities: water and wastewater systems, fire truck pumping capacity and fire station space, municipal and police office space, and police vehicles and ambulances. Classroom space was estimated for school districts. These include most, though not all, of the most costly types of facilities. Requirements were estimated by local use rates, where available, or population-based standards, with present capacities then subtracted. The resulting estimates are order-of-magnitude only, but they highlight those jurisdictions that can expect to have fiscal problems if these developments occur. Capital requirements are not reduced for population declines in 1993 relative to 1988 because the facilities would have to be already built for the peak years.

Counties are excluded from this analysis because many of their facility requirements cannot be estimated by a direct ratio to population. Facilities data was not available for Glenwood Springs and Carbondale. New Castle, Silt, Parachute, and Battlement Mesa are excluded because their projected impacts are small.

TABLE IV-24b
CUMULATIVE SCHOOL DISTRICT BONDING CAPACITY AND CAPITAL REQUIREMENTS
(Thousand dollars)

| | LOW SCENARIO | | | | HIGH SCENARIO | | | |
|---|---|---|---|---|---|---|---|---|
| | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts | No Action | Lease C-11 Only | Lease C-18 Only | Lease Both Tracts |
| Rifle School District | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | $11,000 | $15,600 | $14,800 | $18,600 | $11,000 | $16,900 | $16,100 | $21,200 |
| Capital requirements | 10,500 | 18,400 | 17,000 | 23,500 | 10,500 | 20,700 | 19,200 | 27,900 |
| 1993 | | | | | | | | |
| Bonding capacity | 9,200 | 12,600 | 11,800 | 14,300 | 12,300 | 16,500 | 15,600 | 19,000 |
| Capital requirements | 10,500 | 18,400 | 17,000 | 23,500 | 12,700 | 20,700 | 19,200 | 27,900 |
| Mesa Valley School District | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | 53,200 | 53,300 | 53,300 | 53,400 | 57,100 | 57,200 | 57,200 | 57,300 |
| Capital requirements | 60,400 | 60,700 | 60,700 | 60,800 | 68,200 | 68,400 | 68,400 | 68,600 |
| 1993 | | | | | | | | |
| Bonding capacity | 55,300 | 55,900 | 55,900 | 56,400 | 63,600 | 64,200 | 64,200 | 64,900 |
| Capital requirements | 64,600 | 65,500 | 65,500 | 66,500 | 80,900 | 82,000 | 82,000 | 83,100 |
| Meeker School District | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | 6,500 | 9,700 | 8,500 | 10,600 | 7,000 | 10,900 | 9,800 | 12,600 |
| Capital requirements | 300 | 5,800 | 3,800 | 7,300 | 1,200 | 8,000 | 5,900 | 10,800 |
| 1993 | | | | | | | | |
| Bonding capacity | 6,100 | 8,700 | 7,600 | 9,000 | 7,000 | 10,000 | 8,900 | 10,700 |
| Capital requirements | 300 | 5,800 | 3,800 | 7,300 | 1,200 | 8,000 | 5,900 | 10,800 |
| Rangely School District | | | | | | | | |
| 1988 | | | | | | | | |
| Bonding capacity | 38,200 | 38,900 | 38,700 | 39,100 | 39,300 | 40,100 | 39,900 | 40,500 |
| Capital requirements | 0 | 200 | 0 | 600 | 900 | 2,200 | 1,900 | 3,000 |
| 1993 | | | | | | | | |
| Bonding capacity | 38,100 | 38,600 | 38,400 | 38,800 | 39,200 | 39,800 | 39,600 | 40,000 |
| Capital requirements | 0 | 200 | 0 | 600 | 900 | 2,200 | 1,900 | 3,000 |

(Notes to Table IV-24a also apply to this table.)

TABLE IV-25a
ECONOMIC IMPACTS BY ALTERNATIVE
SUMMARY -- TOTAL IMPACTED AREA

| | Low Scenario | | | High Scenario | | |
|---|---|---|---|---|---|---|
| | Employment (Percent) | Population (Percent) | Communities Revenue (000) | Employment (Percent) | Population (Percent) | Communities Revenue (000) |
| Lease C-11 Only | | | | | | |
| 1988 | 5 | 4 | $1,384 | 6 | 5 | $1,856 |
| 1993 | 3 | 3 | 1,052 | 3 | 4 | 1,354 |
| Lease C-18 Only | | | | | | |
| 1988 | 3 | 3 | 932 | 4 | 4 | 1,393 |
| 1993 | 2 | 2 | 611 | 2 | 2 | 892 |
| Lease Both Tracts | | | | | | |
| 1988 | 8 | 7 | 2,316 | 10 | 9 | 3,279 |
| 1993 | 5 | 5 | 1,654 | 6 | 6 | 2,226 |

TABLE IV-25b
ECONOMIC IMPACTS BY ALTERNATIVE
LEASE C-11 ONLY

| | Low Scenario | | | High Scenario | | |
|---|---|---|---|---|---|---|
| | Employment (Percent) | Population (Percent) | Communities Revenue (000) | Employment (Percent) | Population (Percent) | Communities Revenue (000) |
| 1988 | | | | | | |
| Garfield County | 10 | 8 | | 11 | 11 | |
| Glenwood Springs Carbondale | | 2 | $150 | | 3 | $200 |
| Newcastle-Silt | | 2 | 3 | | 2 | 4 |
| Parachute-Battlement Mesa | | 0 | 1 | | 1 | 2 |
| Rifle | | 26 | 720 | | 35 | 970 |
| Mesa County | * | * | | 0 | * | |
| Grand Junction | | * | 30 | | * | 20 |
| Rio Blanco County | 19 | 19 | | 23 | 24 | |
| Meeker | | 28 | 380 | | 35 | 520 |
| Rangely | | 7 | 100 | | 10 | 140 |
| 1993 | | | | | | |
| Garfield County | 6 | 6 | | 6 | 6 | |
| Glenwood Springs Carbondale | | 1 | 100 | | 1 | 130 |
| Newcastle-Silt | | 2 | 1 | | 2 | 3 |
| Parachute-Battlement Mesa | | 0 | 1 | | 0 | 1 |
| Rifle | | 20 | 490 | | 21 | 640 |
| Mesa County | * | * | | * | * | |
| Grand Junction | | * | 110 | | 1 | 130 |
| Rio Blanco County | 12 | 15 | | 14 | 16 | |
| Meeker | | 20 | 280 | | 24 | 350 |
| Rangely | | 8 | 70 | | 6 | 100 |

## TABLE IV-25c
## ECONOMIC IMPACTS BY ALTERNATIVE
## LEASE C-18 ONLY

| | Low Scenario | | | High Scenario | | |
|---|---|---|---|---|---|---|
| | | | Communities | | | Communities |
| | Employment (Percent) | Population (Percent) | Revenue (000) | Employment (Percent) | Population (Percent) | Revenue (000) |
| 1988 | | | | | | |
| Garfield County | 8 | 6 | | 10 | 9 | |
| Glenwood Springs | | | | | | |
| Carbondale | | 2 | $120 | | 3 | $170 |
| Newcastle-Silt | | 2 | 1 | | 2 | 2 |
| Parachute-Battlement Mesa | 0 | 1 | | | 1 | 1 |
| Rifle | | 19 | 560 | | 28 | 810 |
| Mesa County | * | * | | 0 | * | |
| Grand Junction | | * | 30 | | * | 20 |
| Rio Blanco County | 9 | 8 | | 15 | 14 | |
| Meeker | | 12 | 170 | | 21 | 310 |
| Rangely | | 2 | 50 | | 6 | 80 |
| 1993 | | | | | | |
| Garfield County | 4 | 4 | | 5 | 5 | |
| Glenwood Springs | | | | | | |
| Carbondale | | 1 | 70 | | 1 | 100 |
| Newcastle-Silt | | 0 | * | | 2 | 1 |
| Parachute-Battlement Mesa | | 0 | 1 | | 0 | 1 |
| Rifle | | 14 | 340 | | 15 | 480 |
| Mesa County | * | * | | * | * | |
| Grand Junction | | * | 110 | | 1 | 130 |
| Rio Blanco County | 3 | 4 | | 5 | 6 | |
| Meeker | | 4 | 70 | | 10 | 140 |
| Rangely | | 5 | 20 | | 2 | 40 |

TABLE IV-25d
ECONOMIC IMPACTS BY ALTERNATIVE
LEASE BOTH TRACTS

| | Low Scenario | | | High Scenario | | |
|---|---|---|---|---|---|---|
| | Employment (Percent) | Population (Percent) | Communities Revenue (000) | Employment (Percent) | Population (Percent) | Communities Revenue (000) |
| **1988** | | | | | | |
| Garfield County | 18 | 15 | | 22 | 20 | |
| Glenwood Springs Carbondale | | 4 | $260 | | 5 | $370 |
| Newcastle-Silt | | 2 | 4 | | 4 | 6 |
| Parachute-Battlement Mesa | | 1 | 2 | | 2 | 3 |
| Rifle | | 45 | 1,290 | | 63 | 1,790 |
| Mesa County | * | * | | * | * | |
| Grand Junction | | * | 50 | | * | 40 |
| Rio Blanco County | 28 | 28 | | 37 | 38 | |
| Meeker | | 40 | 560 | | 56 | 840 |
| Rangely | | 12 | 150 | | 16 | 230 |
| **1993** | | | | | | |
| Garfield County | 11 | 10 | | 11 | 11 | |
| Glenwood Springs Carbondale | | 3 | 170 | | 3 | 230 |
| Newcastle-Silt | | 0 | 2 | | 2 | 4 |
| Parachute-Battlement Mesa | | 1 | 2 | | 1 | 2 |
| Rifle | | 33 | 830 | | 35 | 1,110 |
| Mesa County | 1 | 1 | | 1 | 1 | |
| Grand Junction | | 1 | 220 | | 1 | 260 |
| Rio Blanco County | 16 | 19 | | 19 | 23 | |
| Meeker | | 25 | 340 | | 32 | 490 |
| Rangely | | 10 | 90 | | 10 | 130 |

Note: Percent means percent of No Action Alternative
* Less Than one-half percent, or less than $500

4. The C-a to Rangely Road would not be used for product transportation due to lower construction standards.

5. 1980 Colorado State Department of Highways statistics (1908a and 1980b) and statistics prepared by the Department of Highways for BLM were used in conjuction with population and employment estimate presented in the economic section, to project impacts. These are outlined in Tables IV-26 through IV-30.

By 1993, State Highway 13/789, between Rifle and Rio Blanco, Segment A (see Figure III-16) would experience traffic slowdowns, under the Combined Alternative low production rate. Some congestion and occasional decreases in traffic speed would result from either of the single tract alternatives high development scenarios, on Segment A. Under the combined alternative, high production rate traffic on Segment A would often slow to 40 mph. Traffic on the southern portion of Piceance Creek Road Segment B, would often slow to 30 mph.

See Table IV-26 for details on traffic congestion. Large numbers of trucks hauling solid minerals would be the primary source of the traffic congestion. The number of haul trucks is shown in Table IV-27. See Table IV-28 for highway damage costs from product hauls.

Similar to the effects on highway damage, the number of accidents would be highest under the Combined Alternative high scenario and lowest under the single tract low scenario alternatives. Tables IV-29 and IV-30 show the number of total accidents and fatal accidents for the affected segments.

Impacts on highways would be reduced to slightly above those of the No Action Alternative if products are not trucked on the highway. Pipelines could be used to transport shale oil and would eliminate most of the impact on highway segments B2 and E. If a pipeline were constructed to transport ammonia, and a railspur, slurry pipeline, four lane highway, conveyor, or private haul road were constructed from the sites to Rifle, most of the impacts on segments A and B1 would be eliminated.

Of these, a four lane highway would be expensive to build and maintain, water supply for a slurry pipeline would not be adequate, it would be very difficult to obtain easements for a private haul road and a conveyor system would be extremely long. Probably the most feasible way to transport the products would be by pipeline for shale oil and ammonia, and rail for solid minerals.

While both a rail system (URS Engineers) and a pipeline (La Sal) have been proposed for this, neither proposal has been finalized, leaving open the possibility that products would be transported by highway truck for an undetermined length of time.

### Railroads

The effects of the estimated increase in rail traffic through Rifle, to load shale minerals, would not be significant.

## NOISE

Noise increases would occur resulting from machinery operations on the tracts and from increased traffic on Colorado highway 13/789 and Rio Blanco County Road 5 (Piceance Creek Road). The Environmental Protection Agency (EPA) identifies 55 decibels (db) as the significant threshold for sustained noise to a listener. This level of noise, and higher, could cause minor physiological reactions, such as irritability and annoyance, depending upon the sensitivity of the listener.

Noise levels from operating equipment on-site would be raised from 40-45 db to 80-90 db, at the tract boundary. The largest point source for noise is assumed to be secondary crushers at approximately 90 db, measured at 50 feet. The largest linear source of noise is assumed to be overland conveyors at approximately 75 db, measured at 50 feet. Using an attenuation rate of 6 db for point sources, and 3 db for linear sources per doubling of distance, noise from equipment operating on tract could be heard up to five miles away, but would be down to 55 db at approximately one mile from the tract. These estimates represent the most severe anticipated case. Attenuation rates would more probably be between 5 and 6 db per doubling of distance for line sources, and 8 and 9 db for linear sources. If this is the case, noise levels would not be noticeably increased more than one mile from the tract.

The closest residences are approximately five miles from the tract(s). Because of intervening terrain they are protected from any effects of onsite noise increases, although highway noise would be noticeable and may adversely affect the aesthetics of the basically quiet, rural setting, depending on the sensitivity of the listeners.

More noise would be generated during peak operation years (1993) than during construction (1988). Combined effects resulting from both tracts operating at the same time would not be significantly more than one tract. Recreational users, espe-

TABLE IV-26
UTILIZED PERCENT OF HIGHWAY CAPACITY
WITH PEAK HOUR TRAFFIC

| Highway Segment | No Action | C-11 | C-18 | Combined |
|---|---|---|---|---|
| 1988 Low | | | | |
| A Rifle to Rio Blanco | 53 | 61 | 58 | 66 |
| B1 Rio Blanco to Ryan Gulch | 22 | 26 | 24 | 29 |
| B2 Ryan Gulch to White River City | 9 | 11 | 9 | 11 |
| C Meeker to Rio Blanco | 36 | 41 | 39 | 43 |
| D Meeker to White River City | 22 | 24 | 22 | 25 |
| E Rangely to White River City | 18 | 20 | 19 | 20 |
| 1988 High | | | | |
| A | 56 | 67 | 64 | 75* |
| B1 | 24 | 29 | 29 | 35 |
| B2 | 10 | 13 | 12 | 14 |
| C | 39 | 49 | 44 | 50 |
| D | 24 | 27 | 26 | 27 |
| E | 21 | 22 | 21 | 23 |
| 1993 Low | | | | |
| A | 49 | 72 | 66 | 90* |
| B1 | 15 | 39 | 35 | 59 |
| B2 | 8 | 13 | 12 | 18 |
| C | 36 | 39 | 38 | 41 |
| D | 20 | 22 | 21 | 23 |
| E | 18 | 24 | 24 | 30 |
| 1993 High | | | | |
| A | 57 | 100** | 94** | 137** |
| B1 | 24 | 70 | 67 | 111 |
| B2 | 9 | 23 | 22 | 36 |
| C | 38 | 42 | 41 | 45 |
| D | 22 | 24 | 22 | 24 |
| E | 21 | 33 | 32 | 44 |

* Numbers near 85 percent and up to 90 percent indicate momentary traffic slowdowns.
** Numbers just below 100 percent indicate some traffic slowdowns by 10 mph while numbers of 100 percent and above indicate very frequent slowdowns of 10 mph.

TABLE IV-27
PREDICTED NUMBER OF ADDITIONAL HAUL TRUCKS PER DAY

| Production Level For 1993 | No Action | C-11 | C-18 | Combined |
|---|---|---|---|---|
| | FOR DIRECT AND MINE ASSISTED IN-SITU MINING | | | |
| Low | | | | |
| A | 180 | 1,119 | 939 | 2,058 |
| B1 | 180 | 1,119 | 939 | 2,058 |
| B2 | -- | 322 | 322 | 644 |
| C | -- | -- | -- | -- |
| D | -- | -- | -- | -- |
| E | -- | 322 | 322 | 644 |
| High | | | | |
| A | 180 | 2,238 | 2,058 | 4,296 |
| B1 | 180 | 2,238 | 2,058 | 4,296 |
| B2 | | 644 | 644 | 1,288 |
| C | | | | |
| D | | | | |
| E | | 644 | 644 | 1,288 |
| | FOR TRUE IN-SITU MINING ** | | | |
| Low | | | | |
| A | 180 | 220 | 40 | 260 |
| B1 | 180 | 220 | 40 | 260 |
| B2 | -- | 322 | 322 | 644 |
| C | -- | -- | -- | -- |
| D | -- | -- | -- | -- |
| E | -- | 322 | 322 | 644 |
| High | | | | |
| A | 180 | 440 | 260 | 700 |
| B1 | 180 | 440 | 260 | 700 |
| B2 | -- | 644 | 644 | 1,288 |
| C | -- | -- | -- | -- |
| D | -- | -- | -- | -- |
| E | -- | 644 | 644 | 1,288 |

* There would be no production from either tract in 1988
** True in-situ mining will produce only shale oil and caustic soda

TABLE IV-28
ANNUAL HIGHWAY DAMAGE FROM PRODUCT HAULS

| Alternatives | Impacted Segments Dollars in Thousands A* | B* | B2** | E** |
|---|---|---|---|---|
| No Action 1993 (Both Scenarios) | 222 | 218 | 0 | 0 |
| DAMAGE FROM DIRECT AND MINE ASSISTED IN-SITU METHODS | | | | |
| C-11, 1993, Low | 1,380 | 1,358 | 412 | 752 |
| C-11, 1993, High | 2,760 | 2,716 | 824 | 1,504 |
| C-18, 1993, Low | 1,158 | 1,140 | 412 | 752 |
| C-18, 1993, High | 2,316 | 2,280 | 824 | 1,504 |
| C-11 & C-18, 1993, Low | 2,538 | 2,498 | 824 | 1,504 |
| C-11 & C-18, 1993, High | 5,076 | 4,996 | 1,648 | 3,008 |
| DAMAGE FROM TRUE IN-SITU METHOD | | | | |
| C-11, 1993, Low | 270 | 270 | 412 | 752 |
| C-11, 1993, High | 540 | 540 | 824 | 1,504 |
| C-18, 1993, Low | 50 | 50 | 412 | 752 |
| C-18, 1993, High | 490 | 490 | 824 | 1,504 |
| Comb, 1993, Low | 320 | 320 | 824 | 1,504 |
| Comb, 1993, High | 1,030 | 1,030 | 1,648 | 3,008 |

* Damage resulting from: trucking minerals other than shale oil.

** Damage resulting from trucking shale oil.

Note: The dollar values represent increased maintenance costs and the cost of shortened highway life.

TABLE IV-29
PREDICTED TOTAL VEHICLE ACCIDENTS PER YEAR

| Production Level by Year Road Segment | No Action | C-11 | C-18 | Combined |
|---|---|---|---|---|
| Low 1988 | | | | |
| A Rifle to Rio Blanco | 101 | 117 | 110 | 126 |
| B1 Rio Blanco to Ryan Gulch | 31 | 38 | 36 | 42 |
| B2 Ryan Gulch to White River City | 13 | 17 | 14 | 18 |
| C Meeker to Rio Blanco | 81 | 91 | 86 | 95 |
| D Meeker to White River City | 29 | 32 | 30 | 34 |
| E Rangely to White River City | 53 | 56 | 53 | 56 |
| Total | 308 | 351 | 329 | 371 |
| High 1988 | | | | |
| A | 108 | 129 | 122 | 143 |
| B1 | 36 | 45 | 43 | 51 |
| B2 | 15 | 20 | 18 | 22 |
| C | 87 | 100 | 99 | 111 |
| D | 32 | 37 | 34 | 38 |
| E | 60 | 66 | 62 | 67 |
| Total | 338 | 397 | 378 | 432 |
| Low 1993 | | | | |
| A | 93 | 138 | 126 | 171 |
| B1 | 23 | 58 | 51 | 87 |
| B2 | 12 | 23 | 21 | 32 |
| C | 81 | 88 | 84 | 91 |
| D | 28 | 30 | 28 | 31 |
| E | 51 | 70 | 68 | 86 |
| Total | 288 | 407 | 378 | 498 |
| High 1993 | | | | |
| A | 108 | 191 | 179 | 262 |
| B1 | 36 | 103 | 97 | 164 |
| B2 | 15 | 36 | 34 | 55 |
| C | 86 | 94 | 92 | 100 |
| D | 29 | 32 | 30 | 33 |
| E | 59 | 94 | 92 | 126 |
| Total | 333 | 550 | 524 | 740 |

TABLE IV-30
PREDICTED FATAL VEHICLE ACCIDENTS PER 10 YEAR PERIODS *
(1 OR MORE FATALITIES PER ACCIDENT)

| Production Level by Period<br>Road Segment | No Action | C-11 | C-18 | Combined |
|---|---|---|---|---|
| 1988 Low | | | | |
| A Rifle to Rio Blanco | 6 | 7 | 7 | 8 |
| B1 Rio Blanco to Ryan Gulch | 3 | 3 | 3 | 4 |
| B2 Ryan Gulch to White River City | 1 | 1 | 1 | 1 |
| C Meeker to Rio Blanco | 5 | 6 | 5 | 6 |
| D Meeker to White River City | 3 | 4 | 3 | 4 |
| E Rangely to White River City | 6 | 6 | 6 | 6 |
| Total | 24 | 27 | 25 | 29 |
| 1988 High | | | | |
| A | 7 | 8 | 8 | 9 |
| B1 | 3 | 4 | 4 | 4 |
| B2 | 1 | 2 | 1 | 2 |
| C | 5 | 6 | 6 | 7 |
| D | 4 | 4 | 4 | 4 |
| E | 7 | 7 | 7 | 8 |
| Total | 27 | 31 | 30 | 34 |
| 1993 Low | | | | |
| A | 6 | 8 | 8 | 11 |
| B1 | 2 | 5 | 4 | 7 |
| B2 | 1 | 2 | 2 | 3 |
| C | 5 | 5 | 5 | 6 |
| D | 3 | 3 | 3 | 3 |
| E | 6 | 8 | 8 | 10 |
| Total | 23 | 31 | 30 | 40 |
| 1993 High | | | | |
| A | 7 | 12 | 11 | 16 |
| B1 | 3 | 9 | 8 | 14 |
| B2 | 1 | 4 | 3 | 5 |
| C | 5 | 6 | 6 | 6 |
| D | 3 | 4 | 3 | 4 |
| E | 7 | 11 | 10 | 14 |
| Total | 26 | 46 | 41 | 59 |

* The projected number of accidents over a 10 year period is based on the number of fatal accidents for the alternatives in 1988 and 1993 extended over a 10 year period.

TABLE IV-31
SUMMARY OF DAILY ENERGY REQUIREMENTS

| Energy Type | Low Production Rate (25,000 BBLs/day) | | | High Production Rate (50,000 BBLs/day | | |
|---|---|---|---|---|---|---|
| | Direct Mining & Surface Retort | Mine Assisted In-Situ | True In-Situ | Direct Mining & Surface Retort | Mine Assisted In-Situ | True In-Situ |
| Direct Electrical | 642,145 kwh | 419,250 | 2,216,350 kwh | 1,332,800 kwh | 879,360 kwh | 4,431,070 |
| Direct Petroleum Direct | 17,760 gal | 46,000 gal | 33,271 gal | 95,107 gal | 32,407 gal | 66,542 |
| Natural Gas Total | 900,000 scf | 900,000 scf | 900,000 scf | 1,800,000 scf | 1,800,000 scf | 1,800,00 scf |
| Energy Produced* Total | $1.45X10^{11}$ | $1.45X10^{11}$ | $1.45X10^{11}$ | $2.9X10^{11}$ | $2.9X10^{11}$ | $2.9X10^{11}$ |
| Energy Consumed* Energy | $56.79X10^{9}$ | $33.79X10^{9}$ | $39.72X10^{9}$ | $75.2X10^{9}$ | $63.11X10^{9}$ | $75.11X10^{9}$ |
| Ratio of Energy Out: Energy In | 2.55:1 | 4.29:1 | 3.65:1 | 3.86:1 | 4.60:1 | 3.86:1 |

* In BTU's
kwh = kilowatt hour
gal = gallons
scf = standard cubic foot

cially hunters, would be displeased by the increased noise near the tract(s). Noise contours will be developed when the exact location and type of facilities within the tract is known. Intervening topography and vegetation would screen at least a portion of the noise, depending upon location.

Noise increases along the roads between Rifle and the tract(s), caused by increased product haul truck traffic would vary considerably, depending upon alternative. Only moderate noise increases would result during the construction period and for true in-situ methods of mining. Since only shale oil and caustic soda are assumed to be produced under the true in-situ scenario, fewer trucks would be required than for the other scenarios.

All alternatives that involve the other mining methods, during the peak operation years would produce some degree of significant noise increases along the affected road segments. Increases in noise levels would be as follows:

One tract, low level production - 3 db (noticeable increase)

Both tracts, low level production - 5 db

One tract, high level production - 5 db

Both tracts, high level - 9 db (almost doubling the preceived noise level)

Existing noise levels along these road segments (measured at 50 feet) are currently about 69 db. The above increase would add significant noise increases and would affect those residences along these roads to varying degrees, depending upon distance from the road and sensitivity to noise.

## NET ENERGY ANALYSIS

A net energy analysis was completed for each development scenario and production rate. Because a detailed mining and production plan is beyond the scope of this document, general mining and production plans were assumed for use in the energy analysis. Therefore, the energy analysis for C-11 is the same as C-18.

The methodology used in the net energy analysis is set forth in *Energy Analysis Handbook for Oil Shale Development* (Melcher et al 1982). The handbook was developed under a contract with Colorado School of Mines Research Institute for the BLM. The methodology attempts to quantify the energy used to produce energy. The methodology employed "trajectories" broken into modules for each production scenario and rate. Each direct and indirect energy input was traced back to resources in the ground, forming the parameters of the study. The analysis does not include an energy assessment of unrecovered resources. Energy input included operational, transportation, materials and infrastructure energies.

Table IV-31 indicates the daily, direct energy requirements needed for multiple mineral production by energy type and production scenario. The table would seem to indicate that for maximum efficiency, mine assisted in-situ would be the best retorting technology. However, mine assisted in-situ has approximately five percent less recovery rate when compared to room and pillar mining and aboveground retorting. Also, shale oil produced by mine assisted in-situ retorting is better suited for middle distillate (diesel) cuts during refinement while aboveground "Type 4" retorting (a preheated solid comes into contact with the oil shale for retorting) produces shale oil better suited for high distillate (gasoline, kerosene) cuts during refinement.

The energy output to input ratio shown on the table ranges from 2.5-4.6 to 1.0 These ratios are lower than other energy products such as coal because oil shale retorting is very energy intensive and the energy required to produce soda ash, nahcolite and alumina is also included.

The net energy analysis does not vary by tract and differs only by development scenario and production rates. At 25,000 bbls/day or 50,000 bbls/day, either tract would produce approximately 8 million or 16 million barrels of shale oil, respectively, each year. Based on 1981 import figures, this production represents 0.5 percent or 1.0 percent of our annual oil imports respectively. The Combined Alternative would produce either 16 million or 32 million barrels of shale oil. These represent 1.0 percent or 2.0 percent of our annual oil imports.

Of the total direct energy required to produce oil shale, 25 percent of it is electrical. Because of recent load projections, the State of Colorado has expressed concern over the availability of generating capacity to meet the oil shale industry's needs. Electrical generation requirements for either tract will require from 21.9 to 230.8 megawatts of generating capacity, depending on the production scenario and rate. Projections by the Public Utilities Commission indicate that by 1991 Colorado will be a net importer of electricity. The electrical demands of the tracts could be met by increasing imported electricity or by building another generating station within the state. It is unclear whether excess electrical generating capacity is available within the Western Area Power Administration's region. The Moon Lake power plant in Bonanza, Utah may build a second 350 megawatt unit. Also, Colorado Ute Electric is exploring the potential for another generating station in Colorado.

Onsite electrical generation could reduce the electrical requirements in the production process. For example, at Tract C-b the estimated potential for off tract export of surplus electrical power is from 300 to 400 megawatts from low BTU gas boilers, gas turbines, and waste heat boilers. This would be accomplished by recycling the low BTU off gases produced in the retort into a steamboiler or a gas fired generator. However, the technology for low BTU gas fired generators is in its infancy and it is unclear whether they will be technologically and economically viable. Direct energy requirements for mine assisted in-situ could be cut by six percent and for aboveground retorting by eight percent using this co-generation technology. If this technology can be developed, each oil shale project could export between 220 and 320 megawatts of power. This represents between 7.5 X $10^8$ BTU and 1.1 X $10^9$ BTU of additional energy produced. It is unclear whether true in-situ could adopt co-generation technology in its operations.

## EXISTING RIGHTS

Existing rights-of-way could be impacted depending on the mining technique used. The direct mining, surface retort and the mine assisted in-situ mining methods could impact the rights-of-way by either subsidence (if it occurs) or by being covered with spent shale. The true in-situ method could impact the rights-of-way by surface disturbance associated with intensive roads, pipelines and well pad construction needed for that mining method.

Dewatering of the bedrock aquifer system could impact existing surface and groundwater water rights holders. Springs and wells located in the immediate vicinity of the lease tracts should be monitored as should the flow of Piceance and Yellow Creeks in accordance with Environmental Stipulations of the lease Section 1(c)(2).

Leasing of the tracts would complicate, to some extent, concurrent development of oil and gas and oil shale. An agreement with Mineral Management Service, the oil and gas lease holder and the oil shale leaseholder, to allow for the orderly development of both leases would be necessary. This would involve special stipulations being put into the Application for Permit to Drill to protect the mining and recovery of oil shale deposits. A similar stipulation would also be put into new oil and gas leases located within the tract boundaries.

Prior to any oil shale leasing of Tract C-18, an agreement would have to be developed between the government and the current sodium lease holder that would assign the sodium lease to the successful bidder. This assignment will be announced in the *Federal Register* concurrently with the announcement of the lease sale, at least 30 days prior to the sale.

Tract C-11 includes the Bureau of Mines Research Facility at Horse Draw, that may or may not be an advantage to a potential developer. If the lessee determines that the Horse Draw Facility would be beneficial to his operations, an agreement would have to be reached whereby the lessee would assume all liabilities associated with the facility. If not, the Bureau of Mines would reclaim the facility in accordance with their existing, approved reclamation and abandonment plan. If the lessee determines to utilize a portion of the facility, the lessee would be liable for only that portion with the Bureau of Mines assuming liability for the remainder of the facility. If Tract C-11 is offered for lease, potential lessees should indicate how they intend to utilize the facility in the preliminary mine plan submitted at the time of lease sale. The successful bidder would expand this discussion in the Detailed Development Plan.

## SURFACE RECLAMATION AND SOLID WASTE DISPOSAL

Reclamation of the mine facilities, surface retort, and true in-situ borehole activities associated with oil shale leasing would follow standard reclamation practices. Spent shale waste disposal would, however, require more intensive reclamation procedures due to high salinity, potential trace element toxicities, and stabilization problems.

### Mine Facilities and Surface Retort Reclamation

Mine site and surface retort facilities would most likely be located in areas of relatively flat terrain requiring the least construction effort. These areas should have relatively good topsoil salvage. Reclamation of these areas under standard practices would entail removal of all structures, recontouring, replacement of subsoil and topsoil, construction of erosion control structures, seed bed preparation and seeding as required in the Environmental Stipulations of the lease, Section 11. Fertilizer and irrigation practices would follow during the first spring growth and continue until permanent revegetation is established. Fencing would also be necessary to protect the seedlings from livestock grazing until establishment. Establishment of suitable vegetation

could be effective within three to four years after seeding.

True in-situ borehole activities such as roads, pipeline routes, well pads and mine facilities would involve a large disturbance of the tract. Reclamation would be required on several types of soil and vegetation. Intensive reclamation efforts may or may not be necessary on those areas which are sparse in vegetation with south to southwest facing steep slopes. Such sparse vegetation areas would be returned to a cover and composition similar to that which existed prior to disturbance. The principal emphasis would be soil stabilization during plant establishment.

## Spent Shale and Shale Processing Waste Disposal

Spent shale waste would involve surface and underground disposal for both the direct mining with surface retort, and the mine assisted in-situ retort methods. Surface and underground disposal would require consideration of the physical and chemical properties of spent shale as factors that would affect reclamation. These factors are directly related and would vary by the type of retort process used. In addition to the spent shale, there would be other wastes associated with the retorting process and upgrading of the shale oil on site.

Processing of shale and associated minerals would produce spent catalysts, caustics, flocculents, filtering agents, trace elements, sanitary wastes and separator sludges (Crawford et al 1977). Shale oil coke is another expected product if the shale oil is upgraded onsite. If not sold (such as the shale oil coke), these processing wastes become a disposal problem similar to that of the spent shale. Studies have shown that for a 36,000 bbls/day shale oil production rate, these by-products and wastes would amount to only one to two percent (295,000 tons) of the total wastes produced annually (Crawford et al 1977). Similar percentages can be expected for a 25,000 or 50,000 bbls/day operation. Some of these wastes may classify as hazardous wastes under EPA criteria and should be disposed of accordingly. Otherwise, spent shale processing wastes are expected to be disposed of concurrently and in the same manner as retorted shale provided that processed waste including catalyst wastes do not have undesirable effects upon the spent shale piles, environment or disposal sites.

Factors affecting disposal practices of shale wastes involve expansion, compaction, cementation, permeability, seepage and leachates. These factors are directly related to the retorting process in terms of feed preparation, processing, duration, and temperature in the retort. As a result, the retorting process itself can have differing effects upon reclamation and disposal pile dynamics.

New waste disposal technology, refinements in the retorting process, and changes in environmental protection laws would provide changes that could enhance reclamation of spent shale wastes. Flexibility in reclamation techniques and laws is provided under the Environmental Stipulations of the lease, Section 1.(B).

Discussions concerning the compaction, cementation, and permeability of spent shale deal mostly with Paraho and TOSCO spent shale. Spent shale is somewhat unique in the properties previously discussed. Use of the Paraho and TOSCO spent shale data will give an indication of the typical parameters considered for spent shale waste disposal.

### Expansion of Spent Shale

Expansion of shale is due to the crushing process it undergoes prior to surface retorting. When shale is crushed, its volume will double per unit mass; and during retorting 40 percent of this doubled volume will be burned off resulting in a 20 percent net gain in volume over raw shale that is in place (Bloomfield and Stewart 1981). For either the direct mining and surface retort or the mine assisted in-situ method, surface disposal of spent shale would be necessary due to a 20 percent expansion factor.

### Compaction of Spent Shale

Compaction of spent shale would be crucial for adequate underground (backfilling) and surface disposal. Spent shale compacted to 100 pounds per cubic foot or greater would result in good strength and is essentially semipervious to impervious (Bloomfield and Stewart 1981). If spent shale is not compacted to this level, then problems associated with the natural cementation qualities, permeability, leachate quality and seepage probably would occur due to ground and surface waters entering the disposal piles. Compaction to this level has only been performed under laboratory and small scale field conditions. Compaction tests on a large scale, (especially for underground disposal) have not been conducted to test the feasibility or effectiveness of compaction.

The ability to compact spent shale is dependent upon its compressive strength. Compressive strength however, is dependent on retort temperature and retort residence time of the raw shale. Maximum compressive strengths of 270 to 325

pounds per square inch can be obtained at specific temperatures and time in the retort (Bloomfield and Stewart 1981).

Compressive strengths of unconfined spent shale should increase as the spent shale cures or settles. The compressive strength during curing can be affected by the moisture, temperature and particle size of the spent shale. Ninety percent of ultimate strength or more can be obtained in 16 to 28 days of curing (Bloomfield and Stewart 1981; Crawford et al 1977). Some processed shales show a fall off in compressive strength over time. Because long-term studies have not been done on large scale piles of spent shale, it is presently unknown if a pile will retain its stability or whether the compacted (naturally cemented) pile will peak in strength and fall off with time.

For underground disposal, compaction can increase the amount of spent shale to be stowed and increases resistance to saturation by groundwater. To enhance underground (backfilling) compaction strength, the addition of flocculents and cementing agents generally do not work. However, a five to one shale and cement mixture at 15 percent moisture content would increase compressive strengths after eight days of curing (Bloomfield and Stewart 1977). Compaction of surface disposal piles to a semipervious to impervious condition would be necessary to reduce the possibility of slope failure causing mass wasting.

Spent shale fills and embankments are more stable when compacted under dry conditions than under saturated conditions. Studies indicate slopes of two to one and three to one would be stable in dry and saturated piles respectively (Bloomfield and Stewart 1981; Crawford et al 1977). The likelihood of slope failure is reduced if spent shale piles are uniformly compacted with available equipment. Portions of a disposal pile that could induce slope failure are the boundary layers (interfaces) that can occur in a pile, such as (Crawford et al 1977):

1. Valley floor to pile sides
2. Compacted to noncompacted faces
3. Overburden to processed shale faces
4. Topsoil to processed shale faces

### Cementation of Spent Shale

The natural cementing property of spent shale depends upon both particle size and retorting process. To a large degree, natural cementation will determine the stability and maintenance of the compactive strength of spent shale disposal piles. Harbert and Berg (1978), in their studies of vegetative stabilization of oil shale suggest that the natural cementation properties of spent shale will pose fewer long-term environmental problems. Depending on the retort process, spent shale will either be carbonaceous or decarbonized, which can affect the cementation of the shale.

Carbonaceous shales are those shales which were retorted at low temperatures and contain five percent or more organic matter (Crawford et al 1977). Carbonaceous shales, due to their low temperature origin, will have poor cementing qualities at best (when moisturized and compacted). This would decrease the chance of forming a water impervious disposal pile. Leaching through the pile is therefore greater (Bloomfield and Stewart 1981) and pile instability could be increased.

Decarbonized shales are those shales which are processed utilizing residual carbonaceous organic matter as a fuel source for part of the retorting process. Decarbonized shales would have been retorted at approximately 900 degrees Fahrenheit (°F) or more and contain residual carbon of three percent or less. Burning (oxidation) of the residual carbon accompanied by calcining the carbonate minerals at higher temperatures could be a source of process energy resulting in nearly carbon-free shale ash. The result is a shale ash having a composition somewhat similar to Portland cement with certain cement-like properties. Some decarbonized shales with optimum moisture content can obtain 90 percent of its stability in disposal piles within 16 days of curing (Crawford et al 1977).

Grinding of decarbonized shale to finer particle size can enhance natural cementation and improve disposal pile strength (Crawford et al 1977). However, this fine grained material may deteriorate after prolonged exposure prior to compaction while more coarse material is thought to expose fresh reactive surfaces under compactive efforts (Bloomfield and Stewart 1981, Townsend and Peterson 1979). If this is the case, then timing between retorting and disposal of spent shale would become important to obtain compactive strengths with the least effort (Bloomfield and Stewart 1981, Townsend and Peterson 1979).

When sodium and aluminum minerals are extracted concurrently with oil shale, they will be stripped from the shale prior to and after retorting. Once removed, the effect upon natural cementation is presently unknown. Research should be conducted to see what changes, if any, occur and how it could affect the way spent shale wastes would be disposed.

### Cooling of Spent Shale

On a commercial scale, spent shale will have to be cooled either in the open air or by water application prior to placement in disposal sites. Since spent shale will require moisturizing to increase pile stability (for compaction) and natural cementation qualities, water cooling is most likely. The use of cooling ponds or towers to release heat to the atmosphere will be necessary to prevent thermal pollution once the moisturizing or leachate water, if any, is drained from spent shale piles.

## Permeability and Seepage in Spent Shale Disposal Piles

Permeability of spent shale disposal piles can affect the compaction and cementation stability of a pile. Percolation of water into the surface layers of a disposal pile followed by successive periods of wetting and drying, freezing and thawing, deteriorates the effective compaction and cementation of the pile.

Permeability of a disposal pile is directly related to the compactive effort a pile receives and the type of spent shale being compacted. Decarbonized shales, although initially coarse-grained, can be compacted with less effort than fine grained carbonaceous shale to impervious and semipervious conditions. An impervious to semipervious condition reduces percolation significantly.

Seepage into spent shale disposal piles is directly related to the evaporation rate and permeability of the compacted pile. Excess seepage into a disposal pile can cause slope failure and mass wasting resulting in reclamation failure. Greater compaction densities can result in lower seepage rates (Bloomfield and Stewart 1981), but higher runoff rates. This would require water diversions to prevent runoff scour and channelling into the piles. If lower compaction densities are used, then liners under the piles and catchment basins will be necessary to collect any leachates resulting from increased seepage rates. In addition, studies at test site R-3 on Tract C-a indicate that seepage into and through disposal piles can be diminished by placing a layer of soil-like material over the pile. Optimum seepage rates can be obtained by assuring optimum compaction based on the characteristics of the spent shale. Adequate compaction densities can be achieved through the use of grading and hauling equipment, however, compaction by this means may not be uniform causing higher seepage rates. Optimum seepage rates could also be obtained by designing spent shale piles to have an average evaporation rate that would equal the average infiltration rate. However, such a condition would not be conducive to plant growth for reclamation.

## Leachates of Shale Disposal Piles

Successful reclamation of spent shale disposal piles depends on the ability to control the amount and quality of leachates at acceptable levels if they occur. Leachates of inorganic constituents, trace elements, total dissolved solids (TDS), salinity and pH are dependent upon compactive densities and the retorting process used (Bloomfield and Stewart 1981). For example, fluorine and molybdenum were both reduced significantly in leachates of decarbonized shales, but increased in carbonized shales (Stollenwerk and Runnells 1981).

The use of higher temperatures in the retort can control the occurrence of some trace elements in the spent shale. For example, under certain conditions at temperatures greater than 1,200°F boron will become incorporated into insoluble forms of silicated minerals such as akermanite, monticellite and diopside (Stollenwerk and Runnells 1981).

Total Dissolved Solids will be generally higher in retorted shale leachates than raw shale leachates (Stollenwerk and Runnells 1981). There is disagreement between some researchers as to whether TDS will increase or decrease from high temperature decarbonized shales. Stollenwerk and Runnells (1981) found that TDS decreased in high temperature decarbonized shales due to the formation of less soluble mineralization. Crawford et al. (1977), however, found that TDS generally increased in decarbonized shales due to mineral decomposition releasing more soluble salts and the extent of carbon burnoff. TDS levels in leachates from spent shale might be expected to decrease when soluble sodium minerals such as nahcolite are extracted during the processing of shale. Otherwise, TDS can be expected to increase in spent shale-bearing sodium minerals.

Leachate salinity of spent shale is affected by retort residence time and temperature. At very high temperatures, alkalinity content will decrease to some extent with increased retort residence time (Bloomfield and Stewart 1981). Moderate to high retort temperatures, however, will increase the salinity of spent shale because decarbonized shales (more desirable for their natural cementation qualities) are calcined, and these are higher in soluble salt content. Therefore, studies should be conducted to find the retort residence time that would decrease or minimize soluble salt content in decar-

bonized shales to achieve leachates lower in salinity.

Within limited ranges, leachate pH has been found to be directly related to increased temperatures in the retort. The pH of spent shale increases from 9.1 at 1000°F to 11.3 at 1400°F and is probably associated with the increased content of carbonates, hydroxides and alumina at higher temperatures (Bloomfield and Stewart 1981). A pH of 8.5 to 9.0 is considered the level which would inhibit plant growth. The pH in native soils in Piceance Basin range from 7.0 to 8.1, rarely reaching a pH of 8.1. Although some species of plants can grow in soils with a pH of 8.5, these plants are not ecotypic to the Piceance Basin. If spent shale is not made impervious to semipervious, then leachates of higher pH could be expected to cause problems when establishing plants for reclamation.

Control of leachates (if not through the retorting process) would require compactive densities of approximately 100 pounds per cubic foot to make the piles impervious to semipervious. Use of shale retort process water to moisten the spent shale to optimum condition for compaction is not expected to significantly lower the leachate quality from the shale (Bloomfield and Stewart 1981). Another method that can be used to control leachate quality from a disposal pile of spent shale would be to leach the material prior to placement and compaction. Initial leachates from a disposal pile of spent shale would fail to meet EPA recommended water quality criteria for molybdenum, boron, flouride and TDS (Stollenwerk and Runnells 1981). Leachate quality could be improved by leaching with one or two pore volumes of water through the pile to reduce molybdenum, boron and TDS. Fluoride however, will remain high after several leachings of pore volume (Stollenwerk and Runnells 1981). Once leached, piles will have to be drained to a moisture content suitable for compaction. However, leaching and draining of large quantities of spent shale as a final part of the processing, or on large commercial scale disposal piles, has not been conducted to test the effectiveness of such a practice.

Leachates from backfilled mine workings, although not entirely similar to in-situ retort leachates, are thought to be leached in the same manner as in-situ retorted shale. For more information on leachates, refer to Chapter IV, Hydrology, Leachates of Subsurface Retorts section.

Consolidation (compaction) of spent shale to a solid rock-like form is recommended to decrease the surface area of the spent shale if it is exposed. Although this increases the toxicity parameters of the spent shale, the rate of leachate escape is decreased (due to a decreased surface area) to a level and quality that would not be expected to significantly decrease normal water quality. Consolidation could also be achieved by the addition of some type of binder if developed. Consolidation may initially cause an added expense to disposal costs, however, this cost is expected to be offset by the savings from shortened monitoring periods as a result of consolidation.

## Underground Shale Disposal

Underground disposal (backfilling) of spent shale, although more expensive than surface disposal, would reduce total impacts to the surface environment. Backfilling would reduce the potential for subsidence and increase resource recovery through stabilization, allowing for relatively thin support pillars (Bloomfield and Stewart 1981).

Utilizing the direct mining and surface retort method, 75 to 85 percent of the retort material could be placed back into the mine. This would reduce the land area required for surface disposal to 15 to 30 percent of that required for total surface disposal. At a production rate of 50,000 bbls/day, backfilling would decrease surface disturbance to approximately one-half to one acre per day (Bloomfield and Stewart 1981).

Utilizing the mine assisted in-situ retort method, a slightly lesser amount of retort material, like that in the direct mining method, could be placed back into the mine. At full production, the mine assisted in-situ method would decrease surface disturbance to approximately three-quarters of an acre per day.

The most efficient method to backfill a mine for underground disposal is the conveyor. This was found to be true for sublevel stoping, chamber and pillar mining. This method costs approximately twice as much as surface disposal, however, this cost could be offset by the benefit of less surface area requiring reclamation. Benefits of conveyor transport for backfilling are as follows (Bloomfield and Stewart 1981):

1. Low personnel and energy requirements.
2. Low capital and operating costs.
3. Highest pillar support potential.
4. Greatest ability for increased resource recovery.
5. Most retorted shale placement.
6. Least surface disturbance, groundwater contamination, and environmental degradation.
7. Safest overall method.

All spent shale and mine wastes could be potentially backfilled into the mines if the nahcolite and

dawsonite recovery is great enough in volume to offset the expended volume of crushed spent shale (Bureau of Land Management 1979). The volume of material that could be backfilled could be increased if "declined shafts", "drifts" and "mined areas" are sloped enough to allow complete backfilling similar to that of the Superior Oil Company mining plan.

## Aboveground Shale Disposal

Surface disposal of spent shale will occur during two phases: 1) mine development, and 2) development of overlying shale zones above the saline zone (during full shale oil production starting in 1993). This would primarily be 20 to 60 percent of spent shale material that could not be backfilled after surface retorting, and would disturb approximately 1,000 acres or less with the direct mining and surface retort or mine assisted in-situ methods, respectively.

Aboveground disposal of spent shale could decrease total surface disturbance by 200 acres if the 1,000 acres needed for disposal is overlapped onto the disturbance of the mine facilities as the mine is abandoned. This would depend, however, on the sequencing of final retorting and mine facility withdrawal. Stockpiling of the spent shale for a short period of time would be necessary. The main advantage of this would be the reduced cost of not having to strip the disposal area of topsoil, since it would have already been stripped to build the mine facility.

Topsoil or other suitable soil material would be needed to top-dress spent shale disposal piles, reducing the effects of extreme surface temperatures and soluble salts. A capillary barrier would also be necessary to prevent upward migration of soluble salts if not leached below the root zone.

If shrub roots penetrate the spent shale due to insufficient top-dress, then transport and accumulation of molybdenum and boron may occur in the plants (Redente and Cook 1981). Fluoride, which is soluble in spent shale, may also accumulate in these deeper rooting plants. Studies indicate that plants may also accumulate high levels of molybdenum and zinc (Harbert and Berg 1978). Consideration of the shrub species rooting depth is needed in order to prevent possible molybdenosis and fluorosis in animals which would later graze the area.

Because of the potential for upward migration of salts when irrigation ceases, only shallow rooted, salt tolerant plants would be expected to remain in a vegetation community established in a spent shale pile covered with too little topsoil. Also, compacting a spent shale pile to the point where it is semipervious or impervious to water would make the spent shale pile impenetrable to roots, especially deep rooted species such as shrubs. Therefore, depth of the topsoil or suitable soil becomes important to establish a diverse and stable vegetative community. Small plot studies on reclamation of spent shale piles have been made on topsoil depths ranging from 11 to 35 inches (Harbert and Berg 1978, Redente and Cook 1981). Depths of approximately 11 inches required intensive fertilizer and irrigation treatments to reclaim the site. These small plot short-term studies may not adequately reflect environmental conditions on a commercial scale spent shale disposal pile. Some studies suggest that at least 24 inches of suitable plant growth material would be necessary to establish a permanent and diverse plant cover which would be stable over time.

Assuming that the spent shale disposal piles are placed on areas with the shallowest soils, 2,090,000 cubic yards of suitable plant growth material would be available for salvage. This is sufficient to cover the pile to a depth of 15 inches. Because of compaction during placement, settling, and erosion of topsoil material, as little as eight inches could be available for plant growth over time. To cover the pile to a depth of 24 inches, an additional 1,137,000 cubic yards of soil are needed.

Availability of suitable soil could be limited. If the spoil pile is placed where soils are shallowest, only 1,103,000 cubic yards of suitable plant growth material would be available on Tract C-11 and about 2,775,000 cubic yards of suitable plant growth material would be available on Tract C-18. Soil material may have to be borrowed from elsewhere on the tract. In order to adequately top-dress a 1,000 acre spoil pile on Tract C-11, the disturbance of an additional 800 acres may be required. In order to adequately top-dress a 1,000 acre spoil pile on Tract C-18, the disturbance of an additional 700 acres may be required.

Use of subsoil excavated at the disposal sites as suitable plant growth material can decrease the amount of surface disturbance and provide better depth coverage. Perhaps depths greater than 24 inches of top-dress can be obtained at lower cost by excavating additional subsoil at the disposal site rather than hauling in topsoil from elsewhere on the tract. It may be possible to obtain additional suitable plant growth material off of the lease tracts.

Topsoil, once excavated from a disposal pile site, should be replaced as soon as practical to avoid the loss of mycorrhizal and microbial organisms in the soil that are necessary for the success of reseeded plants. Long-term storage of topsoil without vegetative cover decreases the infection potential

significantly and therefore decreases the relative success of revegetation (Redente and Cook 1981).

Revegetation of spent shale disposal piles and mine facilities sites after topsoil coverage would be dependent upon the seed mixtures, irrigation rates, fertilizer type and rates, and short and long-term climatic conditions. Shrubs seeded at twice the rate of grasses will obtain only one-quarter of the total biomass of the established stand; lesser rates of shrubs will favor grass dominance (Redente and Cook 1981). Irrigation and fertilization only accentuate this effect on both favorable and rocky sites.

Topsoil over spent shale piles may eventually erode, exposing the waste material. Exposed shale could exhibit a thin crust of sodium and calcium sulfate particularly during hot weather when evaporation rates are high (Crawford et al. 1977). Exposed spent shale subjected to average erosion in Piceance Basin might contribute 150 pounds of salt per acre along with three tons/acre of suspended material to surface waters annually (Crawford et al 1977). Proper disposal pile location and revegetation practices should not expose any spent shale by erosion for several hundred years.

An additional impact from spent shale exposure results from its dark color. Exposed to direct sunlight, spent shale can reach temperatures of 149°F (Redente and Cook 1981). Such high temperatures would be detrimental to seedling establishment.

Revegetation of spent shale without a covering of suitable plant growth media will require intensive management. Some problems of revegetating spent shale will be dependent upon the retorting process. Generally though, spent shale will be high in soluble salt content. If decarbonized it will be highly alkaline, if carbonaceous it will absorb heat due to its dark color, it will lack adequate nitrogen and phosphorous, it will have essentially no microbial or mycorrhizal activity or potential, and it will contain tract elements such as zinc, boron, molybdenum, and fluorine (Crawford et al. 1977; Harbert and Berg 1978). The texture of the spent shale will also affect reclamation. Its texture will depend upon the processing method, whether it is finely or coarsely ground prior to retorting. For example, alkali sacaton, a salt tolerant grass, had a better percent emergence for seedlings in a sandy loam as opposed to a clay loam soil (Redente and Cook 1982).

If spent shale is to be directly revegetated, then leaching will be required to help reduce the effects of alkalinity and soluble salts (Crawford et al. 1977). Otherwise, it may take greater than three to four years of natural weathering before vegetation will start to establish. Also, the chance of failure is greater and may require additional attempts at seeding and fertilizing (Redente and Cook 1981). Even after three to four years of weathering, unleached Paraho spent shale will still be strongly alkaline, having a pH of 8.8. PH levels could be reduced by the addition of granular sulfur which has been proven to be effective in decarbonized shales (Crawford et al. 1977). However, the high salt content of spent shale, specifically from boron salts, could bring about direct ion effects which may be phototoxic, (Redente and Cook 1981 and 1982).

Water from leaching may be stored in the shale profile and, if suitable, could be used by plants for up to two years before being depleted (Harbert and Berg 1978). A coarse textured spent shale would have a lower water holding capacity (Redente and Cook 1981), whereas a fine textured spent shale will have a higher erosion potential due to a slow infiltration rate (Harbert and Berg 1978). This in turn could cause channeling and incomplete wetting, resulting in pockets of unleached shale (Crawford et al 1977).

Unleached pockets of spent shale would increase the resalinization potential of leached portions due to capillary action and could kill or significantly set back any established perennial vegetation (Crawford et al 1977, Harbert and Berg 1978). Studies are needed to determine the effective leaching rate for sites where spent shale is to be revegetated based upon the type of spent shale and how it was treated before placement (Harbert and Berg 1978).

Fertilization will also be necessary before adequate reclamation of spent shale can be attempted. Spent shale has an adequate content of potassium, however it is lacking in nitrogen and phosphorous (Rendente and Cook 1981, 1982; Crawford et al 1977).

Mulching will also be necessary to reduce the heating effects of the dark colored carbonized shales (Crawford et al 1977). Mulching, fertilizing and leaching will be necessary to create a favorable microclimate for microbial and mycorrhizal relationships which are necessary for nutrient cycling and plant growth. For example, microbial activity in unleached Paraho spent shale was negligible after three years of weathering (Redente and Cook 1981). Therefore, fertilization with nitrogen and phosphorous was recommended to increase the mycorrhizal potential of spent shale (Redente and Cook 1982).

## Location of Shale Disposal Piles

The location of the spent shale disposal areas would dictate how rapidly topsoil cover would erode and expose the shale. Two possibilities exist for

surface disposal of spent shale: 1) deposit spent shale in gently sloping areas, and 2) deposit spent shale in the heads of draws, filling the draws so the only steep watershed is the face of the fill material.

To minimize the effects of erosion, disposal sites should be located in small watersheds or ridges with sideslopes of 4 to 1 or less. This is the maximum slope at which revegetation success is still good. Slopes of 4 to 1 or less should also have control structures to reduce erosion.

### Monitoring of Shale Disposal Piles

Depending on state and federal regulations to prevent shale leachate contamination of surface and groundwaters, monitoring may be required for many years after mine productivity ends. Such monitoring beyond initial vegetative establishment and reclamation becomes less economical with each additional year of monitoring beyond the life of the mine. If, for economic reasons, monitoring should stop, then leachates could occur without resolve. Consolidation of spent shale wastes to a solid rock-like form is recommended to decrease the surface area of the spent shale if it is exposed. Consolidation may initially cause an added expense to disposal costs. However, this cost is expected to be offset by the dollars saved from shortened monitoring periods. If, monitoring should cease for economic reasons, control of leachates to protect Colorado ground and surface waters would become the financial responsibility of the federal government.

### Conclusions

While a great deal of research has been done on reclamation and spent shale disposal, considerable work must still be done to assure successful rehabilitation. The reclamation plan submitted with the Detailed Development Plan must be carefully examined and monitored to avoid unnecessary and potentially serious impacts to the site, to surface and groundwater, and to the long-term productivity of the soil and vegetation on-tract.

Spent shale requires special handling and treatment procedures unique to the resource, while traditional reclamation practices should be effective in reclaiming areas of surface disturbance.

## SUMMARY OF SIGNIFICANT IMPACTS

The significant impacts described in this chapter are summarized below. In addition, mitigation measures which address some of these impacts are proposed in the Uncommitted Mitigation section. This section is a general discussion of the impacts anticipated for the development alternatives. For a more detailed discussion of impacts and their magnitude, refer to the appropriate resource element in this chapter. A comparative summary of impacts of each alternative is included following each alternative described in Chapter II.

### Adverse Environmental Effects Which Cannot Be Avoided

**Air Quality** -- Some pollutants (primarily TSP, $NO_x$ and $SO_2$) will enter the atmosphere regardless of alternative selected or development scenario. However, compliance with state and federal laws should keep these impacts to a minimum.

**Geology** -- Depending upon the development scenario, some 75 percent or more of the oil shale resource and associated minerals would probably be unrecoverable. Currently unknown technologies could conceivably recover more of the in place reserves in the future.

**Floodplains, Alluvial Valleys and Agricultural Lands** -- Between 910 and 2,290 acres of agricultural lands will be converted to urban uses adjacent to existing communities in Mesa, Garfield and Rio Blanco Counties. Depending on the alternative selected and the rate of production, anywhere from 0.3 to 0.9 percent of existing agricultural lands may be urbanized with a corresponding decline in agricultural production. Adequate land to replace these impacted areas is unavailable.

**Soils** -- Soil productivity on 1,200 to 6,800 acres would be reduced during the life of the mine. An undetermined amount of soil and plant nutrients would be displaced from the mined tracts due to erosion.

**Hydrology** -- Water in the vicinity of the lease tract may require treatment prior to municipal or stock water use. This is due to incomplete control of leachate from spent shale wastes and subsurface retorts. In addition springs may be permanently lost due to mine dewatering.

**Vegetation** -- Vegetation on 1,200 to 6,800 acres would be removed from portions of the site during the life of the mine, but would be subse-

quently reclaimed. Undiscovered threatened or endangered plants may be destroyed, resulting in the potential loss of valuable biological data. A temporary loss of 125 to 465 AUMs would occur during the life of the mine, depending on the alternative and development scenario.

**Wildlife** -- There would be a temporary loss of 1,200 to 6,800 acres of wildlife habitat and animal production on lands that would be ultimately reclaimed. A permanent loss of 310 to 2,290 acres of habitat would result from urban development and road construction. Animals would also be lost due to increased vehicle/wildlife accidents and poaching. The estimated annual increase in vehicle related mule deer kills range from 111 to 2,082 depending on alternative and production level. A reduction in habitat effectiveness for big game will result from human disturbance due to human population increases. Habitat loss and reduction in habitat effectiveness would result in a reduction of mule deer carrying capacity from BLM-DOW population objectives by 151 to 549.

**Cultural Resources** -- Destruction or loss of cultural resources could occur if inadvertent disturbance to previously undetected subsurface archaeological sites takes place during construction associated with project development. Possible vandalism due to increased human activity would also be an unavoidable adverse impact.

**Paleontological Resources** -- Many insects, plant and vertebrate fossils could be destroyed during the construction phase, because they might not be seen due to their small size. Since similar plant and insect fossils probably occur in areas outside the sites, the loss would be small.

During shaft sinking, drifting or crosscutting, the loss of vertebrate fossils (especially well preserved fish fossils) would represent a greater loss to science because their salvage is practically impossible under these conditions.

**Recreation** -- Direct impacts resulting from any of the alternatives include the possible displacement of hunting and camping activities and access on the tracts. Indirect impacts include the possibility for increased hunting pressure in the area due to increased local population growth. This could result in decreases in hunter success and even hunting opportunities if a permit system is implemented by the Colorado Division of Wildlife.

**Socioeconomic** -- Significant impacts vary according to the rate of production and the number of employees required. These include demands on local public and private resources for new housing and other capital improvements, competition for labor disadvantageous to local agriculture and business, and local inflation. Also lost would be the lifestyles and values associated with the small ranching towns that will grow into larger communities with a more diverse population, economy and power structure.

**Transportation** -- Increases in traffic on local roads will result in more accidents, fatalities and road repair costs which will vary with the number of employees and the amount of production of each alternative.

**Noise** -- The increased truck traffic between the proposed tracts and Rifle would result in increased noise levels. This could be a significant impact only to residences located within 500 feet of the road under the Combined Alternative with a high production rate.

**Existing Rights** -- Public water reserves may be permanently lost due to mine dewatering.

**Surface Reclamation and Solid Waste Disposal** -- Exposure of surface disposal piles is unavoidable. The location, design, compaction and natural cementation of the wastes would determine the degree of impact. Upon approval of abandonment of mine facilities, monitoring and maintenance of waste disposal piles may become the responsibility of the Federal Government.

## The Relationship Between Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

**Air Quality** -- Air pollution during the life of the mine may result in cumulative, long-term impacts to human health and vegetation. While short-term effects are thought to be insignificant, not enough is known about the long-term effects of air pollution to accurately predict their impact.

**Geology** -- Recovery of oil shale and associated sodium minerals, using present technology in the short-term, could result in a permanent loss of 75 percent or more of the resources. This is due to the potential of developing new technologies in the future that may be more efficient at resource recovery.

**Floodplains, Alluvial Valleys and Agricultural Lands** -- Conversion of 910 to 2,290 acres of agricultural land to urban use as communities expand will result in the long-term loss of the lands' agricultural productivity.

**Soils** -- Soil productivity lost on 1,200 to 6,800 acres during the mine life should be restored to pre-disturbance levels with proper reclamation practices. The exception could be on up to 2,000 acres

of spent shale disposal piles where limited soil cover may be a less productive medium.

**Hydrology** -- Short-term impact to the surface and groundwater resources could occur as a result of mine dewatering. Flow of the White River at the confluence with the Green River will be reduced by approximately four percent for full development of 100,000 bbls/day production, two percent for 50,000 bbls/day production, and one percent for 25,000 bbls/day production per year for the short-term. Salt loads to the White River would be reduced over the short-term. However recovery of the groundwater and surface water systems should occur once mine dewatering closes.

**Vegetation** -- Vegetation on 1,200 to 6,800 acres would be lost through surface disturbance in all alternatives, varying by development scenario. In the long-term, lands impacted under the direct mining with surface retort or mine assisted in-situ methods should return to their potential productivity and natural condition with the possible exception of vegetation on 2,000 acres of spent shale piles. Lands impacted under the true in-situ method should return to a condition where forage production would probably be increased over the existing productivity levels. The potential loss of undiscovered rare or sensitive plants may result in their becoming threatened or endangered as more surface disturbance in the area occurs. Short-term loss of AUMs will be compensated by long-term increases in forage productivity and potentially more AUMs following successful revegetation of the disturbed areas. Pinyon-juniper woodlands disturbed during the life of the project could be reclaimed to existing levels of productivity within 50 to 75 years. Natural regeneration would take up to 100 to 150 years.

**Wildlife** -- Urban development and construction of new road systems could cause a permanent loss of wildlife habitat on 310 to 2,290 acres. Reclamation may not adequately replace wildlife thermal cover or preferred browse of similar type, equal in quantity and quality to that destroyed or affected. Seventy-five to 150 years may be required before adequate reestablishment of pinyon-juniper or other overstory vegetation occurs to winter range. A permanent human population increase would result in continuous secondary off-tract impacts to the wildlife resource. Although unquantifiable, these consequences indicate a decline in wildlife populations, habitat condition, and quantity of habitat available in the long-term.

**Cultural Resources** -- The majority of impacts to cultural resources could occur as a result of surface disturbance from oil shale development. If destruction of cultural sites results, this would create a permanent loss of data.

**Paleontological Resources** -- Loss of paleontological resources through surface and subsurface disturbance would significantly affect the scientific value of the resource in the long-term if steps are not taken to salvage exposed fossils. If left unprotected, they would eventually be lost through weathering or vandalism. This is especially true of the vertebrate, rare plant and late Eocene insect fossils.

**Recreation** -- As game animal populations are reduced, so are the hunting opportunities that provide the greatest recreation in the area. The degree of impact resulting from any of the alternatives would affect a relatively small part of the total opportunities in the region.

**Socioeconomics** -- Almost all of the negative socioeconomic impacts would be short-term in nature: overloaded services and facilities, housing shortages, overworked police, overcrowded classrooms, increases in crime, alcoholism, mental illness, etc. In the long-term, many of these problems would give way to beneficial effects such as housing and infrastructure improvements, growth and diversification of local retail trade and services, and an easing of the social, psychological and structural strains associated with rapid growth.

**Transportation** -- Increased road use, especially from mineral product haul trucks, would significantly increase highway damage and costs to taxpayers in the long-term.

**Existing Rights** -- During the life of the mine, public water reserves may be lost due to mine dewatering. Oil and gas lease holders may be denied access to their leases, effectively postponing oil and gas development on tract until the end of mine life. Some pipelines and road rights-of-way may be permanently relocated due to mining and waste disposal activities.

**Surface Reclamation and Solid Waste Disposal** -- If suitable plant growth material is not used to cover spent shale to a depth suitable for plant growth, then reclamation of spent shale disposal piles could take significantly more time and effort to achieve a stable and acceptable vegetative cover. If a suitable depth of plant growth material is not obtained, then long-term establishment of mature shrub and pinyon-juniper species may be impossible due to their rooting depth requirements.

Short-term reclamation, under the true in-situ scenario, may be intensive due to its widespread disturbance. However, long-term reclamation will be less difficult than for the other mining and retorting methods due to the absence of surface waste disposal piles. Surface waste disposal piles may be reclaimed in the short-term, however with average erosion rates, areas of established vegetation will

decrease as the pile becomes exposed over the long-term.

Introduced species in the seed mixtures will dominate reclaimed areas in the short-term as long as fertilizer and irrigation is utilized to establish vegetation cover under standard reclamation practices. However, as the fertilization and irrigation is discontinued, native species will start to dominate the reclaimed areas over the long-term.

## Irreversible or Irretrievable Commitments of Resources

**Air Quality** -- Some degradation of air quality will be irreversible due to established urbanization in the area after closure of the oil shale facilities.

**Geology** -- Under the direct mining and surface retorting development scenario, 72 percent of the oil shale, and undetermined quantities of the nahcolite and dawsonite would possibly be left unrecovered. Mine assisted in-situ and true in-situ processing could probably result in even more resources being irretrievably lost.

**Floodplains, Alluvial Valleys and Agricultural Lands** -- Urbanization of agricultural lands is permanent and results in an irretrievable loss of agricultural production from those lands.

**Soils** -- Soil and nutrients lost to erosion while sites are disturbed would be irretrievable. The amount of soil lost is related to the amount of area disturbed under each alternative and development scenario, and the success of erosion control onsite.

**Hydrology** -- Loss of some springs, and wells due to mine dewatering may be irreversible. Water quality degradation due to leachates would likely be irreversible. Mixing of the upper and lower aquifers through subsurface and mine dewatering retorting in the Mahogany Zone could be irreversible.

**Vegetation** -- The potential loss of biological data from undiscovered threatened, endangered or sensitive plants would be irretrievable. While the vegetation productivity would be restored through reclamation at the end of mine life, the loss of 125 to 465 AUMs annually during mine life would be irretrievable.

**Wildlife** -- Wildlife habitat lost on 310 to 2,290 acres due to urban expansion and road construction would be irretrievably lost.

**Cultural Resources** -- Destruction of cultural resources would result in an irretrievable loss of additional information to the existing scientific data base.

**Paleontological Resources** -- The paleontological resources are non-renewable; once lost or destroyed they are irretrievable. It is important that at least a representative sample of the fossil record be preserved.

**Recreation** -- Loss of recreation opportunities are tied to the loss of game wildlife habitat. The irretrievable loss of habitat to urban expansion and roads would result in a permanent loss of hunting opportunities. Total irreversible losses would be relatively minor, however.

**Socioeconomics** -- As agricultural land is irretrievably converted for urban expansion, $800,000 to $1,500,000 of annual crop production could be permanently lost. Economic resources would be irretrievably committed to the construction of houses, capital improvements, and commercial, industrial and public structures. Power structure shifts are generally irreversible, as are the changing lifestyles and values of the communities originally built on a western rural cultural base.

**Transportation** -- Increased use of the highways would result in increased traffic accidents, fatalities and property loss proportionate to the rate of production under any alternative.

## Possible Conflicts With The Objectives of Federal, Regional, State and Local Land Use Plans, Policies and Controls for the Area

None of the proposed alternatives would directly conflict with the land use plans of any other agency or governmental entity with jurisdiction in the area concerned. Permitting and other controls are established at the Federal, State and local levels that must be complied with.

Minor adjustments to the Bureau of Land Management's Allotment Management Plan for the Square S Allotment will be required. The existing Management Framework Plan for the White River Resource Area provides for such adjustments in potential oil shale lease areas.

## Mitigation Measures That Could Further Ameliorate The Anticipated Impacts But Are Not Required By BLM (Uncommitted Mitigation)

**Air Quality** -- Residual air quality impacts could be mitigated through additional control of emissions from existing sources. Increased study of pollution

impacts to Air Quality Related Values, and additional background monitoring to better assess regional impacts would assist in better understanding of air quality problems associated with oil shale development in the Piceance Basin.

**Geology** -- Since the proposed tracts are located over the richest resources in the Piceance Basin, mining could be postponed until proven mining technology could recover more of the in place reserves than existing technology. While such technology development is unlikely in the near future, improved processing techniques may eventually evolve.

**Floodplains, Alluvial Valleys and Agricultural Lands** -- In order to direct urban expansion away from agricultural lands, public lands adjacent to communities could be designated for disposal to be used for this purpose. Local planning and zoning is the best tool to control agricultural land conversion, and should be utilized by local governments where this is a problem.

Surface disturbing activities should avoid identified alluvial valleys and floodplains.

**Soils** -- A minimum of 24 inches of suitable plant growth material should be placed on all spent shale disposal piles to ensure that soil productivity could be returned to pre-disturbance levels.

**Hydrology** -- Leaching of spent shale wastes prior to backfilling or abandonment of subsurface retorts will reduce the potential effects of toxic leachates for the long-term. Grouting or filling of the subsurface retorts and backfilling areas with an insoluable material would decrease the potential for leachates in the hydrologic systems.

Springs and public water reserves on and off-tract should be monitored to determine the effect of mine dewatering.

Through proper site selection, retorts could be placed within the Mahogany Zone leaving a sufficiently thick layer of strata between aquifers. By isolating the retorts in this layer of relatively impermeable strata, the rate of leachate transport would be reduced.

A zero discharge policy similar to that in effect on Tracts C-a and C-b should be adopted on any new lease tract.

**Vegetation** -- Additional field surveys for threatened, endangered or sensitive plant species should be conducted prior to any surface disturbing activities. Avoidance of any identified threatened or endangered plant species locations and pinyon-juniper woodlands by relocating surface facilities is recommended.

**Wildlife** -- A proven method of mitigating wildlife impacts on a regional basis has been to establish an "industrial association" among the affected government agencies (BLM, MMS, DOW and USFWS), the lessee(s), C-a, C-b and other energy development companies in Piceance Basin. The objectives of this association could include but are not limited to:

(1) Provide an avenue for coordination between involved companies and agencies to prevent duplication of required efforts in compliance with environmental stipulations of the Oil Shale Lease.

(2) Initiate a team effort to identify adverse impacts and mitigation of cumulative consequences to the wildlife resource from development.

For example, environmental stipulations of the lease require each lessee to monitor and mitigate impacts caused by their actions to the wildlife resource. This indicates, in theory, that each company would be required to monitor and mitigate mule deer/vehicle accidents. Instead of each company performing the same efforts, are association could develop a cooperative agreement between the companies to divide up equal segments of the major road segments and assign individual companies to monitor them. This data could then be compiled together to evaluate mule deer/vehicle accidents on a large scale basis over the entire area impacted.

This example would also apply to other cumulative impacts where the actions of each company contribute to, but are not solely responsible for, the impacts. Once these impacts have been identified, they can also be mitigated in a similar cooperative fashion.

(3) Establish a trust fund to finance field surveys, research projects and mitigation efforts. This would equally distribute costs among companies involved when monitoring and attempting to mitigate cumulative impacts.

(4) Allow interchange of equipment, technology and information between companies for monitoring and mitigation of impacts to the wildlife resource.

Implementation of uncommitted mitigation would reduce the amount of poaching which occurs during travel of employees to and from work. Mass transportation of employees would decrease the total quantity of vehicle/wildlife accidents, especially noticeable for mule deer. Improved technology and better coordination of mitigation efforts from establishment of an industrial association would significantly reduce site specific and cumulative impacts to the wildlife resource from oil shale, multiple min-

eral, and other energy development in Piceance Basin.

**Cultural Resources** -- A monitoring program to observe the effects of subsidence on cultural resources could provide data which could be used to protect cultural sites in the future.

**Paleontological Resources** -- To further evaluate the quality and extent of the paleontological resources in the area, it is recommmended that an intensive paleontological survey, especially of Tongue 5 of the Uinta Formation, be conducted to locate small, hard to see, insect and rare plant fossils, along with the larger vertebrate fossils.

**Recreation** -- Assure continued hunter access along the Yellow Creek Jeep Trail. This would allow recreation access to a large area of hunting outside of the tracts that might otherwise be closed by leasing Tract C-18.

**Socioeconomic** -- Federal contributions to mitigation of economic and social impacts brought about by Federal leasing and land ownership take the form of monies returned to the State. Specific spending and distribution decisions are properly left to the State, County, and community levels. One principle source is the Oil Shale Trust Fund, which goes to the State, which in turn distributes funding among competitive grant applicants from the local level. The Federal government also returns 50 percent of all mineral royalties to the State. In Colorado, the state redistributes 50 percent of these funds to the affected local areas (up to a limit of $800,000 per county). Local governments also receive funds as Payment in Lieu of Taxes (PILT) in counties containing large proportions of federal lands.

Severance funds imposed by the state can also be used for economic and social mitigation; and towns and counties have authority, in addition, to impose zoning, tax prepayments, and other negotiable regulations upon industries for these purposes.

Local authorities, local organizations, interested citizens and industries can take many actions to alleviate economic and social impacts, including tapping into the funding sources described above. Some suggestions for such participation in mitigation are discussed below. Others can be found in the Green River/Hams Fork Final Coal EIS (1980).

Preparation for economic impacts requires lead time. Local governments, highway departments, etc. must be informed of new plans and changes in plans by companies and federal agencies sufficiently far in advance to allow construction of additional facilities ahead of the demand (or cancellation of the preparations before they are irretrievably committed). Likewise, timing of federal actions so that they do not occur at the same time as other large private or public developments would keep local population growth rates from becoming excessive.

Numerous steps can be taken to provide financial assistance, but many would require legislation. Measures to allow prepayment of ad valorem taxes (already passed by the State Legislature), raise severance taxes, share revenues between benefitting and impacted jurisdictions, and require impact assistance by private industry would provide front-end funding for capital improvements and ease pressures on operating budgets. Federal aid programs could be increased, and jurisdictions at all levels could augment the private capital resources available for local housing and business investment.

All of these efforts will be more effective when they are carried out cooperatively by all the public and private interests involved.

Social impacts are more difficult to mitigate; however, some potential measures are recommended: under some conditions, provision for housing especially for single transient workers can be made near a mine site through a trailer park including recreational vehicle spaces (if state or county policies permit). In such instances, adequate eating and recreational facilities would need to be included.

Social services agencies typically have low priority in funding, but these are among the most important mitigators. In western Colorado, these agencies have formed county and Regional Human Resources Councils aimed at identifying local human services needs, gaps in fulfillment of these, sharing ideas for better ways of serving their communities, and obtaining funding especially in the face of cuts in federal monies. Communities could call on these councils and their member agencies for information and guidance in meeting services delivery needs, and could be more strongly committed to funding these less tangible but no less essential services along with allotting money for the more visible needs such as street paving and sewer expansion.

Efforts could be made to identify and welcome new arrivals to the communities (for instance, through cooperation with hiring officials), and to get them (particularly housewives) involved in community activities, to counter the loneliness and isolation typical of new citizens. Some northwest Colorado Human Resources Councils have put together community resources booklets for distribution to newcomers and these help new families become socially oriented. A social outreach program has been started in Garfield County and this type of project is very helpful. Churches and clubs have many opportunities to encourage participation and otherwise to make transients and new residents feel at home.

As identified earlier, energy development produces both winners and losers. An effort must be made to identify these groups. Communities could then examine the social change processes and, understanding these, could seek to direct them so as to minimize adverse impacts and maximize benefits. - Transportation -- Increased traffic congestion, accidents, property loss and damage costs could all be reduced if transportation, other than highway trucking were utilized. Other systems include overland conveyors, railroads and pipelines. If a highway trucking system is utilized the above effects could be minimized by increasing the capacity of existing roads. A combination of transportation systems would probably be most effective. For example, shipping all shale oil and liquids by pipeline, shipping all sodium and alumina minerals by rail and increasing road traffic capacity between Rifle and Rio Blanco and Rio Blanco and the proposed tracts.

**Noise** -- Noise from increased truck traffic could be reduced if other means of transportation were utilized. Other systems include overland conveyors, railroads and pipelines. Obviously, these other forms of transportation would create their own noise and the effects would depend upon the locations. From a noise emission standpoint, a slurry pipeline would be preferred.

**Existing Rights** -- Mine facilities should be designed to minimize impacts to existing rights-of-way, public water reserves, and oil and gas leases.

**Surface Reclamation and Solid Waste Disposal** -- Studies should be conducted on how the retort process can effectively be used to decrease toxicity of shale wastes and thereby decrease reclamation costs and monitoring. An economic assessment should also be conducted to compare the cost of backfilling and compaction with the costs of obtaining enough plant growth material to cover surface waste disposal piles and the cost of the additional reclamation area.

# CHAPTER V

## CONSULTATION AND COORDINATION

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# CONSULTATION AND COORDINATION

In the course of preparing this analysis, several other agencies at all levels of government were consulted formally and informally. The following is a brief discussion of those efforts, and the results.

## Formal Consultation

This is consultation that is required by regulations to formally involve agencies with specific expertise in the environmental impact statement process. At this level of analysis, most of these requirements do not apply, since a specific project development is not proposed. Steps will be taken to secure formal consultation on floodplains, water resources, wetlands, and cultural resources at the time the detailed development plan is submitted to the Minerals Management Service after any leasing of tracts takes place.

Interagency consultation was initiated with the U.S. Fish and Wildlife Service (USFWS) for threatened and endangered species based on the requirements of the Endangered Species Act. BLM has submitted a biological assessment based on the USFWS list of threatened and endangered species which occur on or near the project area. The biological opinion indicates that oil shale leasing would not affect threatened and endangered species or their habitat. However, development of these leases has the potential of impacting the endangered Colorado squawfish in the White River. USFWS provided a recommendation that additional interagency consultation be required when the detailed development plan is submitted and anytime thereafter if significant modifications of the detailed development plan occur. This recommendation was included as committed mitigation.

Consultation with the SCS was completed for prime and unique farmlands via telephone conversation. Information from the Soil Survey of Rio Blanco County Area (SCS 1982, in press) indicating that no prime or unique farmlands are present within the tract boundaries was discussed with the State Conservationist. Based on this, SCS made a recommendation that a statement be included stating the absence of prime and unique farmlands and document the data source. This statement is included and this action has been determined by SCS to adequately fulfill the consultation requirements for this resource.

Consultation with the State Historic Preservation Officer is currently being initiated.

## Coordination

The State of Colorado has been involved from the beginning of the process in reviewing the alternatives to be addressed, providing scoping comments and reviewing portions of the analysis. In addition to the State Clearinghouse, several individual agencies were involved, and are listed in the Distribution List at the beginning of this document.

Rio Blanco County has been involved as well, including the County Commissioners being briefed on the alternatives to be addressed, staff reviewing of portions of the analysis, and participation in the scoping process.

The Minerals Management Service, Oil Shale Office in Grand Junction, Colorado, has provided valuable technical assistance and review throughout the process. They will continue to be consulted on the technical aspects of oil shale development and its consequences.

The Regional Oil Shale Team, an advisory group comprised of representatives of the governors of the oil shale states (Colorado, Wyoming and Utah) and the BLM State Directors of those states, formally reviewed the alternatives to be assessed and recommended their approval by the Bureau. They will continue to provide an advisory role through the remainder of the process.

Other federal agencies have been contacted throughout the process, and their review of the Draft EIS was of great benefit. These agencies are listed in the Distribution List at the beginning of this document.

Agencies at all levels of government that commented on the Draft EIS are listed in Part 2, Comments on the Draft. Their letters have been reprinted in that section as well.

## Scoping

On February 24, 1982, a *Federal Register* notice was issued, announcing public scoping meetings and requesting written comments on the scope of the EIS within 30 days. Several letters were received from organizations and individuals identifying issues that should be addressed in the document. In addition, public meetings were held in Meeker, Colorado on March 24, 1982, Grand Junction on March 25, 1982, and Denver on March 26, 1982.

The results of these meetings were primarily in the form of issues and concerns presented by the public, and these have been summarized and listed in Chapter I, Issues and Concerns. Both those issues that have been addressed, and those that were beyond the scope of the document are listed.

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## CHAPTER V

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# APPENDIX A

## OIL SHALE LEASE

## AND

## ENVIRONMENTAL STIPULATIONS

APPENDIX A

OIL SHALE LEASE AND ENVIRONMENTAL STIPULATIONS

In consideration of the mutual promises, terms and conditions contained herein, and the grant made hereby, this lease is entered into on ________, to be effective on __________, _____, (hereinafter called the "Effective Date"), by the United States of America (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and ____________, (hereinafter called the "Lessee"), pursuant and subject to the terms and provisions of the Mineral Leasing Act of February 25, 1920 (41 Stat. 437), as amended (30 U.S.C. Sec. 181-263) (hereinafter called the "Act"), and to the terms and conditions, and requirements of all regulations promulgated by the Secretary of the Interior (hereinafter called the "Secretary") in existence upon the Effective Date specifically including, but not limited to, the regulations in 30 CFR part 231 and 43 CFR Part 23 and Group 3000, all of which are incorporated herein and, by reference, made a part hereof.

Section 1. Definitions. As used in this lease:

(a) "Oil Shale" means a fine-grained sedimentary rock containing: (1) organic matter which was derived chiefly from aquatic organisms or waxy spores or pollen grains, which is only slightly soluble in ordinary petroleum solvents, and of which a large proportion is distillable into synthetic petroleum, and (2) inorganic matter which may contain other minerals. This term is applicable to any argillaceous, carbonate, or siliceous sedimentary rock which, through destructive distillation will yield synthetic petroleum. The products of Oil Shale include both shale oil and other minerals, including, but not limited to, nahcolite and dawsonite;

(b) "Leased Lands" means ____________________________ situated in the County of Rio Blanco, State of Colorado containing __________ acres, more or less;

(c) "Leased Deposits" means all deposits of Oil Shale lying within or under the Leased Lands;

(d) "Anniversary Date" means the anniversary of the Effective Date of this lease; however, if operations under this lease are suspended pursuant to section 39 of the Act (30 U.S.C. Sec. 209), the next Anniversary Date of this lease after the suspension shall follow the previous Anniversary Date by a period of time equal to the sum of one year and the period of suspension, and subsequent Anniversary Dates will be measured from that Anniversary Date;

(e) "Lease Year" means the period of time between two successive Anniversary Dates of this lease;

(f) "Ton" means a measure of weight of 2,000 pounds avoirdupois;

(g) "Mining Supervisor" means the appropriate mining supervisor of the United States Minerals Management Service defined as the U.S. Geological Survey in 30 CFR 231.2(c);

(h) "Commercial Quantities" means quantities sufficient to provide a return after all variable costs of production have been met;

(i) "Infrastructure" means the set of supporting systems and facilities such as transportation, education, water and sewage, housing, fire and police protection, that support a region's or community's social and economic system; and

(j) "Integrated production" means orderly, concurrent, sequential mining and processing (production) of all portions of the leased deposits, i.e., shale oil and gas, nahcolite, and dawsonite, according to the development schedule contained in the approved Detailed Development Plan as required in Section 10(a). Non-integrated production implies preferential development of some of the minerals in the leased deposits based on justifiable economic, technical, and environmental considerations that temporarily preclude concurrent processing.

Section 2. Grant to Lessee. (a) The Lessee is hereby granted, subject to the terms of this lease, the exclusive right and privilege to prospect for, mine by underground or surface means and process by retorting or by in-situ methods or otherwise, as he may reasonably choose, and in accordance with approved plans utilize and dispose of all Leased Deposits including oil shale, nahcolite, dawsonite and other minerals, together with the right to construct on the Leased Lands all such works, buildings, plants, structures, roads, powerlines, and additional facilities as may be necessary or reasonably convenient for the mining, processing, and preparation of products of the Leased Deposits for market and the housing and welfare of the Lessee's employees, agents, and contractors, and to use so much of the surface of the Leased Lands as may reasonably be required in the exercise of the rights and privileges herein granted.

(b) The lessee shall conduct all operations under this lease in compliance with all applicable Federal, state and local statutes, regulations and standards.

Section 3. Lessor's Reserved Interests in the Leased Lands. The Lessor reserves the following:

(a) The right to lease, sell, or otherwise use or dispose of the surface of the Leased Lands or of any surface or mineral resource in the Leased Lands (or of any interest therein) under existing laws or laws hereafter enacted, subject to the rights of the Lessee under this lease;

(b) The right, upon such terms as it may determine to be just, to permit for joint or several use, such easements or rights-of-way, including easements in tunnels upon, through, or in the Leased Lands, as may be necessary or appropriate to the working of the Leased Lands or other lands containing mineral deposits subject to the Act, and the treatment and shipment of the products thereof by or under authority of the Lessor, its Lessees, or permittees, and for other public purposes; and

(c) The right to conduct and to authorize geological and other investigations on the Leased Lands which do not interfere with or endanger operations under this lease.

Section 4. Lease Term. This lease shall be for a period of 20 Lease Years from the Effective Date and so long thereafter as there is production from the Leased Deposits in commercial quantities, subject to the provisions of section 23 with respect to the readjustment of terms and conditions and the right of the parties to terminate the lease.

Section 5. Bonus. In addition to all other payments required hereunder, the Lessee shall pay to the Lessor the amount of $_____ as a bonus. This bonus shall be due and payable in five installments as follows: Receipt of $_____ at the time of the sale as the first installment is hereby acknowledged by the Lessor; the balance shall be paid in four equal annual installments of $_____ due and payable on each of the first four Anniversary Dates of this lease. In the event the Secretary accepts a surrender or relinquishment of this lease filed by the Lessee at any time prior to the third Anniversary Date, the Lessee shall be released from any obligation to pay the fourth and fifth bonus installments required hereunder. That release shall not relieve the Lessee of the obligation to pay installments which had accrued prior to the filing of the surrender or relinquishment of the lease, but had not been paid prior to the Secretary's acceptance of that surrender or relinquishment. The Lessee may credit against the fourth bonus installment any expenditures prior to the third Anniversary Date directly attributable to operations under this lease on the Leased Lands for the development of the Leased Deposits, but not any expenditures attributable to the preparation of a development plan under section 10 of this lease. Upon the credit of an expenditure, the Lessee shall be relieved of the duty of paying the equivalent amount of the fourth bonus installment. Similarly, the Lessee may credit against the fifth bonus installment any expenditures prior to the fourth Anniversary Date directly attributable to operations under this lease on the Leased Lands for the development of the Leased Deposits and not credited against the fourth bonus installment, but not any expenditures attributable to the preparation of a development plan under section 10. Upon the credit of an expenditure, the Lessee shall be relieved of the duty of paying the equivalent amount of the fifth bonus installment. The Mining Supervisor shall have the duty of determining whether expenditures credited by the Lessee are properly attributable to such operations, and, if the Mining Supervisor determines that any reported expenditure is not attributable to such operations, the Lessee shall not receive credit for that expenditure.

Section 6. Rentals. The Lessee shall pay the Lessor an annual rental which shall be in the amount of 50 cents for each acre or fraction of an acre of the Leased Lands. The Lessee shall pay the rental for each subsequent Lease Year on or before the first day of that Lease Year. Rentals for any Lease Year shall be credited by the Lessor against any royalty payments for that Lease Year.

Section 7. Royalties. Royalties shall be computed and assessed in the same manner as that used on the leases issued in the 1974 Federal oil shale prototype lease sale.

(a) The Lessee shall pay to the Lessor a royalty on all Oil Shale extracted by the Lessee from the Leased Lands which is either processed or sold by the Lessee. The royalty on Oil Shale shall be computed separately for shale oil and for other minerals as follows:

(1) The royalty on shale oil shall be computed on the basis of the shale oil content of the Oil Shale; the method of computing the royalty shall depend upon whether the Oil Shale is extracted by mining methods or processed by in-situ methods.

(i) If the Oil Shale is extracted by mining methods, the Lessee shall pay the Lessor a basic royalty rate of 12 cents on every Ton of Oil Shale which the Lessee either processes under the Lease either on or off the Leased Lands or sells prior to processing. This basic royalty rate shall be subject to the following adjustments:

(A) If the shale oil content of the Oil Shale mined is less than 30 gallons per Ton, the basic royalty rate per Ton of Oil Shale shall be reduced by one cent for each gallon or fraction thereof that the shale oil content is less than 30 gallons per Ton, but in no event shall the royalty rate be less than four cents per Ton. If the shale oil content of the Oil Shale mined is more than 30 gallons per Ton, the basic royalty rate per Ton shall be increased by one cent for each gallon or fraction thereof that the shale oil content is more than 30 gallons per Ton.

(B) The royalty rate determined under (A) above shall be adjusted by an increase or decrease of the same percentage as the Producer's Price Index for crude petroleum (Domestic P.P.I.-0561) from the latest index immediately preceding the month for which royalties are due as compared with the Producer's Price Index for crude petroleum for March 1974 (formerly known as the Domestic Wholesale Price Index). However, in no event shall the basic royalty rate for shale oil be decreased to less than 4 cents on every Ton of Oil Shale mined under the lease.

(C) The shale oil content of the Oil Shale shall be determined either by the Modified Fischer Assay method or by such other method as the Lessor and the Lessee adopt, and the royalty shall be based on the monthly average of shale oil content of all Oil Shale processed under this lease or transferred from the Leased Lands for processing or sale by the Lessee. Computations of quantities, assays and royalties shall be rounded to the nearest hundredth, or within the limits of the standard deviation for commercial testing equipment as approved by the Mining Supervisor.

(ii)(A) If the Oil Shale is processed by in-situ methods, royalty shall be paid at a basic royalty rate of 12 cents per Ton. The number of Tons processed shall, for purposes of computing royalty, be determined by: (I) establishing through calorimetric tests designated by the American Society for Testing and Materials as "Standard" or "Tentative," the total gross heat of combustion in BTUs of all oil and gas products from retorting prior to treatment, adjusted downward by the total gross heat of combustion in BTUs of combustible fluids (gases or liquids) injected as heat carriers, but not for fuel purposes, into the formation being processed; (II) dividing the adjusted total gross heat of combustion in BTUs by 152,700 BTUs (shale oil and gas recovered by Modified Fischer Assay of Oil Shales, containing approximately 30 gallons of shale oil per Ton, has a heating value of 152,700 BTUs per gallon of shale oil and associated gas), to arrive at the equivalent number of gallons of shale oil produced; and (III) dividing the equivalent number of gallons of shale oil produced by 30, to arrive at the number of Tons of Oil Shale processed by in-situ methods.

(B) The basic royalty rate applicable to shale oil from Oil Shale process by *in-situ* methods shall be adjusted in the same manner as that provided in paragraph (a)(1)(i)(B) of this section for the adjustment of the basic royalty rate applicable to shale oil processed from Oil Shale extracted by mining methods.

(C) Computations of quantities, assays, and royalties relating to tonnage of Oil Shale shall be determined by the same standards as used under Section 7(a)(1)(i)(C).

(2) The Lessee shall also pay a royalty on all minerals, other than shale oil, contained in Oil Shale produced from the Leased Deposits which the Lessee processes, either on or off the Leased Lands, or sells; except that no royalty shall be required where the Lessee demonstrates to the satisfaction of the Mining Supervisor that the cost of producing the mineral exceeds the gross value at the point of shipment to market, and that the mineral was processed only as a consequence of the Lessee's need to comply with the Oil Shale Lease Environmental Stipulations. This royalty shall be computed on the basis of the gross value of the other minerals at the point of shipment to market, and shall be at a rate of 3 per centum for the first ten Lease Years, 4 per centum for the eleventh year through the fifteenth Lease Year, and 5 per centum beginning with the sixteenth Lease Year.

(b) The Lessee shall determine accurately, on the Leased Lands, the weight or quantity and quality of all Oil Shale produced from the Leased Deposits by each method used and shall enter the weight or quantity and quality thereof accurately in books which shall be kept and preserved by the Lessee for such purposes.

(c) Payments for royalties due under this lease shall be payable monthly on or before the last day of the calendar month following the calendar month in which the Oil Shale is processed or, if it is not processed, is sold.

(d) If the Lessee shall show that compliance with the requirements for environmental protection prescribed in the detailed development plan (or amended, supplemental, or partial plan) required under section 10 of this lease, and as approved in accordance with the regulations in 43 CFR Part 23 and 30 CFR Part 231, now or hereinafter in force, or imposed by legislation enacted after the effective date of that plan (or of an amendment or supplement to that plan), has engendered or will engender extraordinary costs in an amount which is in excess of those in the contemplation of the parties, as determined by the Lessor, on the effective date of that plan (or amendment or supplement to that plan), and the Secretary, if he deems it desirable, may, in order to offset such costs, adjust the royalties that would otherwise become due and payable thereafter under subsection (a) of this section by allowing a credit against those royalties in such an amount, and for such a time as he determines is warranted in the circumstances.

(e)(1) For the sixth and each succeeding Lease Year the Lessee shall pay a minimum royalty which, to the extent that royalties on production during that Lease Year in that amount have not been previously paid, shall be due and payable on the Anniversary Date at the end of that Lease Year. For the sixth Lease Year, the Lessee's minimum royalty shall be equal to the royalty due on

shale oil under subsection (a)(1)(i) of this section on an annual production rate of ________ Tons of Oil Shale containing ________ gallons of shale oil per Ton of Oil Shale. The annual production rate for computing minimum royalty for each subsequent Lease Year up to and including the fifteenth Lease Year shall increase in an amount of ________ Tons of Oil Shale per year for each subsequent Lease Year; for the fifteenth and each subsequent Lease Year the annual rate shall be ________ Tons of Oil Shale. The Secretary may excuse the Lessee from compliance in whole or in part, with the requirements of this paragraph (1) of subsection (e) during any year in which the Lessee is prevented by circumstances over which he has no control from implementing a development plan submitted under Section 10 of this lease.

(2) The Lessee may credit against any minimum royalty due on the sixth Anniversary Date or any subsequent Anniversary Date up to and including the tenth Anniversary Date the amount of any expenditures which are made between the approval of the development plan under Section 10 of this lease and the tenth Anniversary Date and which are directly attributable to operations on the Leased Lands pursuant to that development plan for the development of the Leased Deposits and which were not credited against the fourth and fifth bonus installments. The Mining Supervisor shall have the duty of determining whether expenditures credited by the Lessee are attributable to such operations, and, if the Mining Supervisor determines that any reported expenditure is not attributable to such operations, the Lessee shall not receive credit for the expenditure. Upon the credit of an expenditure against the minimum royalty due, the Lessee will be relieved of the duty of paying the equivalent amount of minimum royalty: Provided, however, That, if there is actual production in the sixth or any subsequent Lease Year, the Lessee shall not be permitted to credit expenditures against the first $10,000 of minimum royalty due for that Lease Year.

(f) If the Lessee enters into production prior to the eighth Anniversary Date, and the royalty due in the eighth or any previous Lease Year exceeds the minimum royalty due under subsection (e)(1) of this section for that Lease Year, the Lessee shall be relieved from the payment of one-half of the difference between the actual royalty due for that Lease Year and the figure set in subsection (e)(1) for minimum royalty due for that Lease Year. This relief from the payment of royalty shall be in addition to any crediting of expenditures under subsection (e)(2) of this section, but no crediting of expenditures against minimum royalty shall reduce the figure for minimum royalty used in the preceding sentence.

Section 8. Payments. All bonus installments shall be paid to the appropriate State Office of the Bureau. All rental payments shall be made to the appropriate State Office of the Bureau until this lease enters a producing status or minimum royalty is required to be paid on it; thereafter the rentals and royalties shall be paid to the appropriate Mining Supervisor with whom all reports (including any reports on expenditures deductible under section 5) concerning operations under the lease shall be filed. All remittances to the Bureau shall be made payable to the Bureau of Land Management; those to the Minerals Management Service shall be made payable to the United States Minerals Management Service.

Section 9. Bond.

(a) The Lessee shall file with the appropriate Bureau office and maintain a bond in the amount of $40,000 (adjusted periodically to reflect the prevailing rise in cost of living) for the purpose of ensuring compliance with the provisions of this lease, except those provisions for compliance with which a separate bond is required under subsection (b) of this section.

(b)(1) Upon approval of a detailed development plan under section 10 of this lease, the Lessee shall file with the appropriate Bureau office and maintain, in addition to the bond required under subsection (a) of this section, a bond (in an amount determined pursuant to paragraph (2) of this subsection) which shall be conditioned upon the faithful compliance with the regulations in 30 CFR Part 231 and 43 CFR Part 23, the provisions of sections 10 and 11 of this lease, the Oil Shale Lease Environmental Stipulation attached to this lease pursuant to section 11, and any approved development plan (or approved, amended, supplemental or partial plan), to the extent that it relates to the preservation and protection and conservation of resources other than Oil Shale during the conduct of exploration or mining operations, and the reclamation of lands and waters affected by exploration or mining operations.

(2) During the first three Lease Years after the approval of detailed development plan under section 10 of this lease, the bond shall be in an amount not less than (i) $4,000 per acre for all portions of the Leased Lands which, pursuant to the plan, will be used for spent shale disposal sites and sites for actual mining operations during that three year period and (ii) $1000 per acre for all other portions of the Leased Lands upon which operations will be conducted or which will be directly affected by operations during that three year period under the plan, but the total bond shall in no event be less than $40,000. After the first three Lease Years the bond shall be renewed at intervals of three Lease Years. Each renewed bond shall be for three Lease Years and at such a total figure as shall be determined by the Mining Supervisor to be needed to provide for the reclamation and restoration of all portions of the Leased Lands which have been affected by previous operations under this lease or which will be affected by operations under this lease during the ensuing three year period. The amount of the bond shall be increased at any time during the three-year period at the demand of the Mining Supervisor if there is a change in the development plan which, in the opinion of the Mining Supervisor increases the possibility of environmental damage. Upon request of the Lessee, the bond may be released as to all or any portion of the Leased Lands affected by exploration or mining operations during the three year period covered by the bond when the Lessor has determined that the Lessee has successfully met the reclamation requirements of the approved development plan and that operations have been carried out and completed with respect to these lands in accordance with the approved plan.

(c) Prior to the approval of any plan for exploratory work under section 10(d) of this lease, the Lessee shall file with the appropriate Bureau office and maintain, in addition to the bond required under subsection (a) of this section, a bond in such an amount as the Mining Supervisor shall require, but in no event less than $40,000, which shall be conditioned upon the faithful compliance with regulations in 30 CFR Part 231 and 43 CFR Part 23, the provisions of sections 10 and 11 of this lease, the Oil Shale Lease Environmental Stipulations attached to this lease pursuant to section 11, and any approved plan for exploratory work, to the extent that it relates to the preservation and protection of the environment (including land, water, and air), the

protection and conservation of resources other than Oil Shale during the conduct of exploration operations, and the reclamation of lands and waters affected by exploration operations. The bond required by this subsection shall apply only to actions taken prior to the date of approval of the development plan under section 10(a) of this lease. However, with the consent of the Mining Supervisor, the Lessee may modify this bond in such a manner as is necessary to meet the requirements of subsection (b) of this section, and the bond so modified may, with the consent of the Mining Supervisor, be maintained as the bond required under subsection (b).

Section 10. Development Plan and Diligence Requirements.

(a) The Lessee shall file with the Mining Supervisor on or before the third Anniversary Date a detailed development plan. This plan shall include: (1) a schedule and description of the planning, exploratory, development, production, processing, reclamation, and monitoring operations and all other activities to be conducted under this lease; (2) a detailed description pursuant to 30 CFR Part 231 and 43 CFR Part 23 of the procedures to be followed to assure that the development plan, and lease operations thereunder, will meet and conform to the environmental criteria and controls incorporated in the lease and make use of best available environmental control technology; and (3) a requirement that the Lessee use all due diligence in the orderly development of the Leased Deposits, and, in particular, to attain, at as early a time as is consistent with compliance with all the provisions of this lease, production at a rate at least equal to the rate on which minimum royalty is computed under section 7(e)(1).

If the lessee elects to develop the minerals in the leased deposits in a non-integrated manner, the detailed development plan must contain information showing to the satisfaction of the Mining Supervisor that integrated development is not viable and justifiable for economic, technical or environmental reasons, and that development will not preclude future recovery of other minerals in the leased deposits. If the development and production of any portion of the leased deposits are to be temporarily postponed, the Detailed Development Plan must show when all minerals will be developed.

Prior to commencing any of the operations under the development plan in the Leased Lands, the Lessee shall obtain the Mining Supervisor's approval of the development plan. The Mining Supervisor shall not delay unnecessarily in the consideration of a development plan, but he shall take time to consider both technical and environmental provisions of the plan thoroughly prior to approval, and shall hold public hearings on the environmental provisions to assist him in his consideration of the detailed development plan. If the development plan submitted by the Lessee is unacceptable, the Mining Supervisor shall inform the Lessee by written notice of the reasons why the development plan is unacceptable and shall give him an opportunity to amend the plan. If an acceptable development plan is not submitted to the Mining Supervisor by the Lessee within one year after the Lessee's receipt of that notice, the Mining Supervisor shall send a second written notice to the Lessee concerning the unacceptability of the development plan. A failure by the Lessee to submit an acceptable plan within one year after his receipt of the second written notice, without reasonable justification for delay, shall be grounds for termination of the lease, if the Lessor so elects.

Upon approval of the plan, the Lessee shall proceed to develop the Leased Deposits in accordance with the approved plan. After the date of approval of the development plan, the Lessee shall conduct no activities upon the Leased Lands except pursuant to that development plan, or except for necessary activities following a relinquishment under section 28 of this lease or for the disposition of property after termination pursuant to section 32 of this lease.

(b) The Lessee must obtain the written approval of the Mining Supervisor of any change in the plan approved under subsection (a).

(c) The Lessee shall file with the Mining Supervisor annual progress reports describing the operations conducted under the development plan required under subsection (a).

(d) Prior to undertaking any exploratory work on the Leased Lands between the Effective Date and the date of approval of the detailed development plan required by subsection (a) of this section, the Lessee shall file with the Mining Supervisor a plan showing the exploratory work which he proposes to undertake and he shall not commence that work until the Mining Supervisor has approved the plan.

Exploratory work, as used in this subsection, shall include, but not be limited to, seismic work, drilling, blasting, research operations, cross-country travel, the construction of roads and trails and other necessary facilities and the accumulation of environmental baseline data required under section 1(C) of the Oil Shale Lease Environmental Stipulations. Prior to approval of the detailed development plan under subsection (a) of this section, all exploratory work on the Leased Lands shall be conducted pursuant to a plan approved under this subsection.

Section 11. Protection of the Environment; additional stipulations.

(a) The Lessee shall conduct all operations under this lease in compliance with all applicable Federal, State, and local water pollution control, water quality, air pollution control, air quality, noise control, solid waste disposal and land reclamation statutes, regulations, and standards.

(b) The Lessee shall avoid, or, where avoidance is impracticable, minimize and, where practicable, repair damage to the environment, including the land, the water and air.

(c) The Oil Shale Lease Environmental Stipulations are attached to and specifically incorporated in this lease. A breach of any term of these stipulations will be a breach of the terms of this lease and subject to all the provisions of this lease with respect to remedies in case of default.

Section 12. Operations on the Leased Lands; Water Rights.

(a) The Lessee shall exercise reasonable diligence, skill, and care in all operations on the Leased Lands. The Lessee's obligations shall include, but not be limited to, the following:

(1) The Lessee shall conduct all operations on the Leased Lands so as to prevent injury to life, health, or property.

(2) The Lessee shall avoid, or where avoidance is impracticable, minimize and, where practicable, correct hazards to the public health and safety related to his operations on the Leased Lands.

(3) The Lessee shall avoid wasting the mineral deposits, and other resources, including but not limited to, surface resources, which may be found in, upon, or under such lands.

(b) The Lessee shall conduct all operations on the Leased Lands whether they are surface or underground operations, and whether they are in lands in which the Lessor owns the surface or those in which the Lessor has disposed of the surface, in accordance with the provisions of 30 CFR Part 231 and 43 CFR Part 23. Both 30 CFR Part 231 and 43 CFR Part 23 are specifically incorporated by reference into the provisions of this section. The provisions of 43 CFR Part 23 are hereby expressly made applicable to the Lessee's underground mining operations with equal force and effect to that given to those provisions in their application to surface mining operations and to operations on lands in which the Lessor owns the surface.

(c) The Lessee shall take such reasonable steps, and shall conduct operations in such a manner, as may be needed to avoid or, where avoidance is impracticable, to minimize and, where practicable, repair damage to: (1) any forage and timber growth on Federal or non-Federal lands in the vicinity of the Lease Lands; (2) crops, including forage, timber, or improvements of a surface owner; or (3) improvements, whether owned by the United States or by its permittees, licensees, or lessees. The Mining Supervisor must approve the steps to be taken and the restoration to be made in the event of the occurrence of damage described in this subsection.

(d) All water rights developed by the Lessee on the Leased Lands shall immediately become the property of the Lessor. As long as the lease continues, the Lessee shall have the right to use those water rights free of charge for activities under the lease in accordance with applicable state laws.

Section 13. <u>Development by In-Situ Methods</u>. Where in-situ methods are used for development of Oil Shale, the Lessee shall not place any entry, well, or opening for such operations within 500 feet of the boundary line of the Leased Lands without the permission of, or unless directed by, the Mining Supervisor, nor shall induced fracturing extend to less than 100 feet from that boundary line.

Section 14. <u>Nuclear Fracturing</u>. No nuclear explosive may be detonated on or in the Lease Lands without the express written approval of the Secretary. The Secretary may approve the detonations of such explosives only after the preparation of an environmental impact statement pursuant to section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. Sec. 4332(2)(C)).

Section 15. <u>Inspection and Investigation</u>. The Lessee shall permit any duly authorized officer or representative of the Department at any reasonable time:

To inspect or investigate the Leased Lands and all surface and underground improvements, works, machinery, and equipment, and all books and records pertaining to operations and surveys or investigations under this lease; and copy and make extracts from any books and records pertaining to operations under this lease.

Section 16. Reports, Maps, etc.

(a) At such times and in such a form as the Mining Supervisor may prescribe the Lessee shall furnish a report with respect to investment and operating costs under this lease. The Lessee shall also submit to the Mining Supervisor in such form as the latter may prescribe, not more than 60 days after the end of each quarter of the Lease Year, a report covering that quarter which shall show the amount of each respective mineral or product produced from the Leased Deposits by each method of production used during the quarter, the character and quality thereof, the amount of products and by-products disposed of and price received therefor, and the amount in storage or held for sale. This report shall be certified by the superintendent of the mine, or by some other agent having personal knowledge of the facts who has been designated by the Lessee for that purpose.

(b) The Lessee shall submit to the Mining Supervisor at such times and in such form as the Mining Supervisor may prescribe, operational data, including but not limited to, raw and processed oil shale analysis, flow rates and analysis of solid, liquid, and gaseous streams.

(c) The Lessee shall prepare and furnish at such times and in such form as the Mining Supervisor may prescribe, maps, photographs, reports, statements and other documents, required by the provisions of 30 CFR Part 231 and 43 CFR Part 23.

Section 17. Notice. Any notice which is required under this lease shall be given in writing. Where immediate action is required, notice may be given orally or by telegram, but, where this is done, the oral notice shall be confirmed in writing. Wherever this lease requires the Lessee to give notice, notice shall be given to the Mining Supervisor unless this lease requires that notice be given to another officer. The Lessee shall inform the Bureau State Office and the Mining Supervisor of the Lessee's officer to whom notice shall be given.

Section 18. Employment Practices. The Lessee shall pay all wages due persons employed on the Leased Lands at least twice each month in lawful money of the United States. The Lessee shall grant all miners and other employees complete freedom of purchase. The Lessee shall restrict the workday to not more than 8 hours in any one day for underground workers, except in cases of emergency. The Lessee shall employ no person under the age of 16 years in any mine below the surface. If the laws of the State in which the mine is situated prohibit employment, in a mine below the surface, of persons of an age greater than 16 years, the Lessee shall comply with those laws.

Section 19. Equal Opportunity Clause; certification of non-segregated facilities.

(a) Equal Opportunity Clause. During the performance of this lease the Lessee agrees as follows: (1) The Lessee shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee shall take affirmative action to insure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee shall post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee shall, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee shall send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules regulations and relevant orders of the Secretary of Labor.

(5) The Lessee shall furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of the said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee shall include the provisions of Paragraphs (1) through (7) of this subsection (a) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor or vendor. The Lessee shall take such action with respect to any contract, subcontract or purchase order as the Secretary may direct as a means

of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor or vendor as a result of such direction by the Secretary, the Lessee may request the lessor to enter into such litigation to protect the interests of the lessor.

(b) Certification of non-segregated facilities. By entering into this lease, the Lessee certifies that Lessee does not and shall not maintain or provide for Lessee's employees any segregated facilities at any of Lessee's establishments, and that Lessee does not and shall not permit Lessee's employees to perform their services at any location, under Lessee's control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause in this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. Lessee further agrees that (except where Lessee has obtained identical certifications from proposed contractors and subcontractors for specific time periods) Lessee shall obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that Lessee shall retain such certifications in Lessee's files and shall make them available to the Secretary at his request; and that Lessee shall forward the following notice to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods): Notice to prospective contractors and subcontractors of requirements for certification of non-segregated facilities. A Certification of Non-segregated Facilities, as required by the May 9, 1967, order (32 FR 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semi-annually, or annually).

Section 20. Taxes. The Lessee shall pay, when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the Lessee.

Section 21. Monopoly and Fair Prices. The lessor reserves full authority to promulgate and enforce orders and regulations under the provisions of sections 30 and 32 of the Act (30 U.S.C. Sec. 187 and 189) necessary to insure that any sale of the production from the Leased Deposits to the United States or to the public is at reasonable prices, to prevent monopoly, and to safeguard the public welfare, and such regulations shall, upon promulgation, be binding upon the Lessee.

Section 22. Suspension of Operations or Production. Any suspension of operations or production under section 39 of the Act (30 U.S.C. Sec. 209) granted with respect to this lease shall take effect as of the first day of the calendar month following the calendar month during which the suspension is approved, except that, in a situation where in the opinion of the Mining Supervisor there is an immediate danger to life, or of irreparable major damage to property or the environment, the Mining Supervisor may grant a suspension effective immediately. The term of any suspension granted pursuant to the Lessee's request with respect to operations or production under this lease shall be in full calendar months. A suspension shall terminate either at the time designated in the suspension order or, if there is no time of termination in the order, at such time as the Mining Supervisor shall designate in subsequent notice to the Lessee.

Section 23. Readjustment of Terms and Conditions. The Lessor may propose the reasonable readjustment of the terms and conditions of this lease (including royalty provisions), the first readjustment to be effective at the twentieth Anniversary Date of this lease and subsequent readjustments to be effective at twenty Lease Year intervals thereafter. At least 120 days before the appropriate Anniversary Date the Lessor shall give notice to the Lessee of any proposed readjustment of the terms and conditions of the lease and the nature thereof, and, unless the Lessee, within 60 days after receipt of such notice, files with the Lessor an objection to the proposed terms or relinquishes the lease as of the appropriate Anniversary Date, the Lessee shall be deemed conclusively to have agreed to such terms and conditions. If the Lessee files objections with the Lessor, and agreement cannot be reached between the Lessor and Lessee within a period of 60 days after the filing of the objections, the lease may be terminated by either party upon giving 60 days' notice to the other party; however, the Lessor's right to terminate the lease shall be suspended by the Lessee's filing of a notice of appeal pursuant to section 34 of this lease. If the Lessee files objections to the proposed readjusted terms and conditions, the existing terms and conditions (other than those concerning royalties) shall remain in effect until there has been an agreement between the Lessor and the Lessee on the new terms and conditions to be incorporated in the lease, or until the Lessee has exhausted his rights of appeal under section 34 of this lease, or until the lease is terminated; however, the readjusted royalty provisions shall be effective until there is either agreement between the Lessor and the Lessee or until the lease is terminated. If the readjusted royalty provisions are subsequently rescinded or amended, the Lessee shall be permitted to credit any excess royalty payments against royalties subsequently due to the Lessor.

Section 24. Assignment. With respect to the assignment or transfer of any interest under this lease, the Lessee shall comply with the provisions of 43 CFR Subpart 3506 to the same extent as if that Subpart were specifically applicable to oil shale leases. The Lessor shall have no discretion to refuse to approve an assignment except: (1) where the assignee is not qualified to hold a lease under section 1 of the Act (30 U.S.C. Sec. 181); (2) where the assignee is unable to provide an adequate bond; or (3) where either the assigned or the retained portion of the lease would, in the opinion of the Lessor, be too small to be economically developed.

Section 25. Overriding Royalties. The Lessee shall not create, by assignment or otherwise, an overriding royalty interest in excess of 25 percent of the

rate of royalty payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, except that, where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Department that he has made substantial investments for improvements on the lands covered by the assignment.

Section 26. Heirs and Successors in Interest. Each obligation hereunder shall extend to and be binding upon, and every benefit shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Section 27. Unlawful Interest. No member of, or Delegate to, Congress or Resident Commissioner, after his election or appointment, either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Section 3741 of the Revised Statutes of the United States (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433, Title 18 of the United States Code, relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

Section 28. Relinquishment of Lease.

(a) Upon showing to the satisfaction of the Lessor that he has complied with the terms and conditions of this lease, the Lessee may relinquish the entire lease or any legal subdivision of the Leased Lands.

(b) A relinquishment must be filed, in duplicate, in the proper Bureau State Office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety, in accordance with the terms and conditions of this lease, (1) to make payment of all accrued bonus payments, rentals, and royalties, except as provided in section 5; (2) to provide for the preservation of any mines, in-situ production works, underground development works, other permanent improvements, and other property, whether fixtures or personalty, on the Leased Lands; (3) to provide for the reclamation of lands and water affected by exploration or mining operations under this lease; and (4) to comply with all other applicable requirements of this lease.

Section 29. Remedies in Case of Default. If the Lessee shall fail to comply with any of the terms and conditions of this lease (including the terms and conditions of any development plan approved under section 10) and that default shall continue for a period of 30 days after service of notice thereof by the Mining Supervisor, the Mining Supervisor may suspend operations until the required action is taken to correct noncompliance, or the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in Section 31 of the Act (30 U.S.C. Sec. 188) and for forfeiture of any applicable bond. If the Lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or to prevent danger to the employees, or to avoid, or, where avoidance is impracticable, to minimize and, where practic-

able, repair damage to the environment, or, if immediate action by the Lessor, without waiting for action by the Lessee, is required for any of those purposes, the Lessor may enter on the premises and take such measures as he may deem necessary to prevent such loss, damage, or danger, or to correct the damaging, dangerous, or unsafe condition of the mine or any other facilities upon the Leased Lands, and those measures shall be at the expense of the Lessee.

Section 30. Effect of Waiver. A waiver of any breach of the provisions of this lease shall extend only to that particular breach and shall not limit the rights of the parties with respect to any future breach. A waiver of a particular cause of forfeiture shall not prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Section 31. Delivery of Premises in Case of Forfeiture. In case of the termination of this lease in any manner the Lessee shall deliver to the Lessor, in the condition required by the reclamation requirements of approved exploration and development plans, and subject to the provisions of section 32 of this lease, the Leased Lands, including permanent improvements and other property on the Leased Lands, whether affixed to the ground or movable and all underground shafts and timbering, well casing, and such other supports and structures as are necessary for the preservation of the Leased Lands, or any mines, other underground development works, or deposits in the Leased Lands.

Section 32. Disposition of Property upon Termination of Lease.

(a) Upon termination of this lease in any manner all underground timbering and any other supports or structures which the Lessor shall inform the Lessee are necessary for the preservation of any mines or other underground development works shall become and remain thereafter a part of the realty without the payment of any compensation to the Lessee. All other structures, equipment, machinery, tools, appliances, and materials on the Leased Lands, whether affixed to the ground or movable, shall remain the property of the Lessee upon the termination of this lease, but the Lessee shall have no right, for a period of six months following the termination, to remove from the Leased Lands any of that property which in the opinion of the Lessor is useful for the protection of the Leased Lands (including any mines in those lands) unless the Lessor shall expressly authorize the removal. During the six-month period the Lessor shall have the right to purchase at the appraised value any or all items of that property required or useful for the protection of the Leased Lands. The appraised value shall be fixed by three disinterested and competent persons (one to be designated by the Lessor, one by the Lessee, and the third by the two so designated), and the appraised value determined by the three or a majority of them shall be conclusive.

(b) At any time within a period of 90 days after either the Lessor has informed the Lessee that he will not purchase the property or the expiration of the 6-month period, the Lessee shall have the right to remove from the premises the property which was not purchased by the Lessor.

(c) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee as provided above, which are allowed to remain on the Leased Lands shall become the property of the Lessor on expiration of the 90-day period or any extension of that period which may be

granted by the Lessor because of adverse climatic conditions or other good and sufficient reason, unless the Lessor shall direct the Lessee to remove any or all of such property on expiration of the 90-day period. If the Lessor directs the Lessee to remove such property, the Lessee shall do so at his own expense or, if he fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Section 33. Protection of Proprietary Information.

(a) This lease, and any activities thereunder, shall not be construed to grant a license, permit or other right of use or ownership to the Lessor, or any other person, of the patented processes, trade secrets, or other confidential or privileged technical information (hereafter in this section called "technical processes") of the Lessee or any other party whose technical processes are embodied in improvements on the Leased Lands or used in connection with the lease. Notwithstanding any other provision of this lease, the Lessor agrees that any technical processes obtained from the Lessee which are designated by the Lessee as confidential shall: (1) not be disclosed to persons other than employees of the Federal Government having a need for such disclosures; (2) not be copied or reproduced in any manner except as required specifically by the Mining Supervisor; and (3) not be used in any manner that will violate their proprietary nature unless the Mining Supervisor shall make a written determination that such technical processes do not contain trade secrets or are not confidential, or unless such disclosure is required by court order or statute; provided however, that before any such publication or disclosure, except where the overriding national interest demands otherwise, the Mining Supervisor shall notify the Lessee of the proposed disclosure and those to whom the disclosure will be made, provide a copy of the written determination and allow the Lessee 30 days to submit additional material supporting its claim of confidentiality or otherwise to initiate an appeal from the decision of the Mining Supervisor prior to any disclosure.

(b) In the event the lease is terminated and the Lessor elects pursuant to section 32 to purchase machinery or equipment the use of which would involve technical processes in the operations of the purchased machinery, the Lessor shall have the right to use those technical processes in the operations of the purchased machinery or equipment; provided that (1), with respect to third parties' technical processes which the Lessee has obtained the right to use by contract or agreement, the Lessor shall replace the Lessee as a party to the contract or agreement, and (2) with respect to technical processes owned, developed or controlled by the Lessee itself, the Lessor shall agree to pay the Lessee fair market value for use of the Lessee's technical processes in said operations. Any contract or agreement into which the Lessee shall enter with a third party for the right to use technical processes belonging to that third party shall provide that the Lessor may become a party to that contract or agreement to the extent that those processes may be used for the protection of the Leased Lands. If the Lessee and the Lessor shall not agree as to the fair market value of the Lessee's technical processes, that value shall be determined as provided in section 32(a) for other property acquired by the Lessor upon termination of the lease.

Section 34. Lessee's Liability to the Lessor.

(a) The Lessee shall be liable to the United States for any damage suffered by the United States in any way arising from or connected with Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the United States acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the United States from any and all claims arising from or connected with Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Section 35. Appeals. The Lessee shall have the right of appeal (a) under 43 CFR 300.4 from any action or decision of any official of the Bureau, (b) under 30 CFR 231.74 from any action, order, or decision of any official of the Minerals Management Service, or (c) under applicable regulation from any action or decision of any other official of the Department, arising in connection with this lease, including any action or decision pursuant to section 23 of this lease with respect to the readjustment of terms and conditions.

Section 36. Interpretation of This Lease.

(a) The paragraph headings in this lease are for convenience only, and do not purport to, and shall not be deemed to, define, limit, or extend the scope or intent of the paragraph to which they pertain.

(b) As used in this lease, unless the context clearly indicates otherwise, a word in the masculine or neuter form shall be interpreted as equally applicable to the masculine, feminine, and neuter genders, and words in singular form shall be interpreted as equally applicable to singular and plural numbers.

(Appropriate signature lines)

OIL SHALE LEASE
ENVIRONMENTAL STIPULATIONS

Section 1. GENERAL

(A) Applicability of Stipulations. The terms, conditions, requirements and prohibitions imposed upon Lessee by these Stipulations are also imposed upon Lessee's agents, employees, contractors, and sub-contractors, and their employees. Failure or refusal of Lessee's agents, employees, contractors, subcontractors, or their employees to comply with these Stipulations shall be deemed to be the failure or refusal of the Lessee. Lessee shall require its agents, contractors, and subcontractors to include these Stipulations in all contracts and subcontracts which are entered into by any of them, together with a provision that the other contracting party, and its agents, employees, contractors, and subcontractors, and the employees of each of them, shall likewise be bound to comply with these stipulations.

(B) Changes in Condition. These Stipulations are based on existing knowledge and technology. They may be revised or amended by mutual consent of the Mining Supervisor, the Bureau District Manager, and the Lessee at any time to adjust to changed conditions or to correct an oversight. The Lessor may amend these stipulations at any time without the consent of the Lessee in order to make these stipulations consistent with any new Federal or State statutes for the protection of the environment upon their enactment and with regulations issued under those statutes. The Lessee, the Mining Supervisor, and the Bureau District Manager shall meet at least once a year to review advances in technology and, in a mutual endeavor, weigh and decide the feasibility and need of revising or amending existing Stipulations.

The Lessor and the Lessee agree that, in this mutual endeavor to decide upon the feasibility and need for amending the existing Stipulations, they will act in good faith and in a sincere effort to make the Lessee's activities under the lease as free from environmental damage as is practicable. Toward this end, systems which require pollution control devices shall possess sufficient flexibility to adopt improved technology at practicable intervals and shall be constructed with the understanding that continued compliance with changing pollution control laws is required.

(C) Collection of Environmental Data and Monitoring Program.

(1) The Lessee shall develop and submit for approval of the Mining Supervisor a comprehensive environmental monitoring program as a part of the exploration plan, required by Section 10(d) of this lease.

The Lessee, following approval of the exploration plan, shall immediately implement the monitoring program which shall continue before, during, and subsequent to development operations. The environmental monitoring program shall be conducted until the Mining Supervisor has determined to his satisfaction that environmental conditions have been established after the termination of development operations which are consistent with the requirements of applicable Federal and State Statutes and regulations; however, the Mining Supervisor may terminate this requirement at an earlier date where it is in the public interest.

The purposes of the environmental monitoring program are: to determine environmental conditions existing prior to any development operations under the lease; to provide data for the design of an environmentally responsive detailed development plan required by section 10 of the lease; to provide a record during and subsequent to development of changes in the environment from conditions existing prior to development and from control sites where appropriate; to provide a continuing check on compliance with provisions of the lease (including these attached stipulations), and all Federal, State and local environmental protection and pollution control requirements; to provide timely notice of detrimental effects and conditions and; to provide a factual basis for revision or amendment of these stipulations pursuant to Section 1 (B) hereof. In determining conditions existing prior to development, the Lessee may supplement site specific data with data compiled by others as approved by the Mining Supervisor. The source and substance of any such data shall be identified in the exploration plan required by Section 10(d) of the lease. Environmental data approved by the Mining Supervisor shall be collected for at least one full year and a report analyzing the year's data shall be submitted prior to submission of the detailed development plan. The environmental monitoring program shall be updated at the time of submission of the detailed development plan and may, at the discretion of, or with the approval of the Mining Supervisor, be modified at any time as necessary as a result of information obtained after approval of the environmental monitoring program.

The detailed development plan required by Section 10 of the lease, shall at the discretion of, or with approval of the Mining Supervisor, be modified at any time as necessary as a result of study of the monitoring data obtained after approval of the detailed development plan. Exploratory operations as approved by the Mining Supervisor, shall be permitted during the collection of environmental data.

(2) In conducting the environmental monitoring program, the Lessee shall adopt the following methods and shall obtain the information required below. The location and number of testing and sampling installations shall be determined by the Lessee unless otherwise directed by the Mining Supervisor. The environmental monitoring program shall include a quality assurance program approved by the Mining Supervisor which demonstrates sound experimental design consistent with the current state-of-the-art to assure high quality data collection. the Lessee shall initiate appropriate analytical and statistical determination of significant changes and trends. In the design and operation of the environmental monitoring program, the Lessee shall collect data for the duration of activities on the leased tract unless otherwise directed by the Mining Supervisor. Intra and interrelationships among biotic and abiotic parameters shall be determined, evaluated, and reported for direct and indirect impacts. The quality assurance program shall include, but not be limited to: quality control by standard reference materials, such as those available through established criticia of acceptablilty (e.g., EPA Air Quality Handbook and 10 CFR Part 50 Appendix D); method and frequency of calibration and maintenance, and testing programs to identify and quantify data validity and anomalies.

The Lessee shall maintain records of all information obtained under the environmental monitoring program and shall submit such records to the Mining Supervisor in a format and at intervals to be prescribed by him. Lessee shall

promptly notify the Mining Supervisor of detrimental effects, conditions, and trends. In addition to the report analyzing the first year's environmental data, the Lessee shall submit quarterly progress reports during the collection of the first year's data. Not more than one year after obtaining approval of the detailed development plan and on each subsequent anniversary date the Lessee shall submit to the Mining Supervisor a report of the environmental monitoring programs as a part of the required annual progress reports on the development program. This portion of the annual report will be subject to public review and comment. The reports required by this paragraph and other reports required by the Mining Supervisor shall be submitted in quantities to be determined by him.

(a) Surface Water. The Lessee shall construct gauging stations on the major drainages of the leased lands and, as required by the Mining Supervisor, upstream and downstream from the leased lands. Data collected at the stations shall include continuous streamflow records, continuous specific conductance records, continuous water temperature records, continuous precipitation records, continuous sediment records, and as directed by the Mining Supervisor, periodic analyses for selected inorganic and organic chemical constituents. Precipitation records shall include, data on short-term intensity of precipitation and on the chemical constituents in precipatation as approved by or as directed by the Mining Supervisor. The Lessee shall obtain data on the physical and chemical character of stream sediments at gauging stations and at other appropriate locations on streams that drain areas on and about the tract as directed by the Mining Supervisor. The Lessee shall compile an inventory of water features such as wells, springs and seeps on and about the lease tract. Such inventory shall include biotic and abiotic information, such as flow and physical and chemical properties or features, and utilization of such hydrologic features by flora and fauna.

(b) Groundwater. At each proposed or actual mine site, the Lessee shall drill a test well and shall, as directed by the Mining Supervisor, install one or more observation wells in each water-bearing zone defined by the test well. The Lessee shall collect samples of drill cuttings and shall make geophysical logs as directed by the Mining Supervisor. The Lessee shall isolate each water bearing zone penetrated by the test wells and shall conduct aquifer tests on each zone, as approved by or as directed by the Mining Supervisor. Aquifer testing shall be for the purpose of obtaining information about the water-bearing characteristics of each zone and about the effects of pumping on wells, springs, seeps, and streams in the area. The Lessee shall determine the water quality during aquifer tests by analyzing water samples for organic and inorganic chemical constituents, including, without limitations, trace constituents subject to drinking water standards and water pollution control regulations. The Mining Supervisor may require analysis of samples for such additional constituents as he may deem necessary. After the initial test, the lessee shall collect water samples from each well at intervals directed by the Mining Supervisor and analyze them for evidence of trends in water quality as determined by comparing the analyses with previous analyses.

The Lessee shall complete at least one observation well upgradient from each impoundment and raw or spent shale disposal site and at least two observation wells downgradient from these sites at depths and locations specified by the Mining Supervisor. The Mining Supervisor may require additional observation wells both on and off the lease tract to quantify effects on groundwater

hydrology and to provide adequate monitoring of the water quality of aquifers or water-bearing zones. The Lessee shall record water levels and temperatures in each observation well pursuant to a measurement schedule established by the Mining Supervisor. The Lessee shall determine the water quality of each observation well by analyzing samples for organic and inorganic constituents, including, without limitation, trace constituents subject to drinking water standards and water pollution controls. The Mining Supervisor may require analysis of samples on such a schedule and for such additional constituents he may deem necessary. After the initial test of an observation well, the Lessee shall collect water samples from the well at intervals directed by the Mining Supervisor and analyze them for evidence of trends in water quality as determined by comparing the analyses with previous analyses.

(c) Air Quality and Meteorology. The Lessee shall submit for the Mining Supervisor's approval an Air Quality and Meteorology monitoring program designed to define the existing environment, define meteorology factors which might influence the transport and diffusion of pollutants which might be emitted by source on or near the tracts, identify the meteorology of the area for detailed planning purposes, monitor impacts of lease development and operation on air quality, determine source and magnitude of plant emissions, and provide information for plant operation to minimize impacts of operations.

In the collection of data to meet the above stated objectives, the Lessee shall record air quality, using strategically-located stations. The number and location of stations shall be recommended by the Lessee and approved by the Mining Supervisor. Once established pursuant to this stipulation the number and location of such stations shall not be changed except by mutual consent of the Mining Supervisor and Lessee.

The Lessee shall collect air quality data for all pollutants that the Mining Supervisor determines are necessary, based on the Lessees' submittal of a detailed description of emissions anticipated during development, including but not limited to sulphur dioxide, hydrogen sulphide, suspended particulates, hydrocarbons, oxides of nitrogen, ozone, and carbon monoxide.

In addition, the Lessee shall establish a meteorological station in reasonable proximity to each proposed plant site to record, at a minimum, wind direction and speed (vane and anemometer) at two levels, one at least 30 meters above the surface of the plant site, one at approximately 10 meters above the surface of the plant site, and temperature at two levels, one at least 30 meters above the surface of the plant site, and one at approximately 10 meters above the surface of the plant site, and humidity at the lower level. An upper air data collection program shall be implemented as deemed necessary by the Mining Supervisor for the purpose of obtaining information for diffusion modeling.

(d) Flora and Fauna. The Lessee shall conduct studies of the flora and fauna of the leased lands and of all other lands lying within a mile of the leased lands, and of all lands to be used for disposal of residues from mining and processing oil shale and associated minerals, and also of the aquatic habitat as far downstream as the Mining Supervisor shall require. The selection of sampling periods for these studies will be based on the latest available scientific information, and must be approved by the Mining Supervisor. Flora

studies will determine species composition, condition, density, cover, productivity, and utilization by terrestrial fauna and by vegetation type and, where applicable, aquatic fauna. Fauna studies will determine species, population indices and/or density, behavior parameters, daily and seasonal movement patterns, and habitat utilization and preference for terrestrial fauna and, where applicable, aquatic fauna.

(e) Soil Survey and Productivity Assessment. The Lessee shall conduct an intensive soil survey and productivity assessment of all portions of the leased lands not previously mapped by the Soil Conservation Service with a Class I survey. This survey must include the preparation of maps, tables, and reports describing soil types and series, depth of the various layers of soil horizons, but not more than a depth of 50 feet from the surface, strike and dip of the material, slopes, solar exposure, vegetative cover, erodability, and other physiographic freatures as required by the Mining Supervisor. The Soil Conservation Service standard procedures shall be used in meeting the requirements of this stipulation. A soil chemistry program, approved by the Mining Supervisor, is required for all areas to be directly affected by on-tract operations.

(3) The environmental monitoring program shall be an integral part of the detailed development plan required in Section 10 of the lease, and at the time of the submission of the plan the Lessee shall provide the Mining Supervisor with a complete compilation of the baseline data collected above and the record of the monitoring program for any period subsequent to the conclusion of that compilation.

(4) Not more than one year after obtaining approval of the detailed mining plan and on each subsequent anniversary date the Lessee shall submit to the Mining Supervisor a report of the baseline data collected and a report of the monitoring programs as a part of the required annual progress reports on the development program. This portion of the annual report will be subject to public review and comment.

(D) Emergency Decisions. Any decisions or approvals of the Mining Supervisor required by these Stipulations to be in writing may in emergencies be issued orally, with written confirmation as soon thereafter as possible.

(E) Environmental Briefing. During the life of this Lease, Lessee shall provide that such Federal and State employees as may be designated by the Mining Supervisor shall be briefed on environmental and other pertinent matters. The Lessee shall provide for such briefings upon the request of the Mining Supervisor, but the Mining Supervisor shall request only such briefings as may be reasonably necessary to effectuate the provisions of this Lease. Lessee shall make arrangements for the time, place, and attendance at such briefings. Lessee shall bear all costs of such briefings other than salary, per diem, subsistence and travel costs of Federal and State employees.

(F) Construction Standards. The general design of all buildings and structures shall comply with the latest edition of the Uniform Building Code (U.B.C.). Structural steel shall be designed in accordance with the latest edition of the American Institute of Steel Construction "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings." Reinforced concrete shall comply with the latest edition of the "American

Concrete Institute's Building Code Requirements for Reinforced Concrete." Engineering works for impoundments shall conform to standard engineering practice sufficient to withstand the 100-year flood in the drainage in which installed. All impoundments shall be constructed to minimize leakage, unless otherwise authorized by the Mining Supervisor.

(G) Housing and Welfare of Employees. The Lessee, in the exercise of his right under section 2 of the Lease to construct buildings and other facilities for the housing and welfare of his employees, shall at all times make certain that these facilities are situated, constructed, operated, and maintained in an orderly manner, satisfactory to the Mining Supervisor. While no general restriction is imposed upon the construction of facilities necessary to the employees' health and well-being, such construction shall be subject to the Mining Supervisor's approval and shall not unreasonably damage the environment of the leased lands.

(H) Firearms. The carrying of firearms by employees while on the job or in company owned vehicles, with exception of security guards, shall be prohibited.

(I) Posting of Stipulations and Plans. The Lessee shall ensure that copies of these Stipulations and any approved exploration and development plans are available at the operating sites and for inspection by all on-the-ground operating personnel. Notice prohibiting carrying of firearms onto the tract by employees shall be prominently displayed at all entrances to the tract.

(J) Employee Transportation. The lessee shall use mass transit of employees wherever possible to reduce chance of accidents, traffic congestion, and road kill of wildlife.

Section 2. ACCESS AND SERVICE PLANS

(A) Transportation Corridor Plans. The Lessee shall provide corridor plans for roads, pipelines and utilities on the Leased Lands for approval by the Mining Supervisor. Each plan shall include probable major design features and plans for the protection of the environment, control of pollution, minimization of erosion, rehabilitation and revegetation of all disturbed areas not required in operation of the transportation system, both during and after construction. The Lessee shall, to the maximum extent practicable, make use of multi-use corridors for roads, pipelines and utilities.

(B) Regulation of Public Access. After road construction is completed, the Lessee shall, upon consultation with the Lessor, permit reasonable, free and unrestricted public access to and upon the road and rights-of-way for all lawful and proper purposes except in plant sites, mine sites, disposal areas, and other operational areas which may be closed to the general public. The Lessee shall regulate public access and public vehicular traffic as required to facilitate operations and to protect the public and, to the extent reasonable, livestock and wildlife from hazards associated with construction. For this purpose the Lessee shall provide warnings, flagmen, barricades, and other safety measures as necessary. Whenever the Mining Supervisor shall determine that the Lessee's regulation of access and traffic is unreasonable, or that the Leseee's provision of safety measures is inadequate, he shall so inform the Lessee who shall immediately take corrective measures.

(C) Existing and Planned Roads and Trails. Where feasible, the Lessee shall use existing roads and trails. Unless the Mining Supervisor shall direct otherwise, roads and trails shall be located, constructed, maintained, and closed according to the specifications of the Bureau of Land Management and shall include drainage structures where needed.

(D) Waterbars and Breaks. The Lessee shall divert runoff from roads and uphill slopes by means of waterbars, waterbreaks, or culverts constructed in accordance with Bureau specifications.

(E) Pipeline Construction Standards. In the design and construction of oil pipelines and the choice of materials for them, the Lessee shall follow the standards (wherever they may be made applicable) established by the Department of Transportation and, if these standards should ever be revised, supplemented, or superseded, shall follow the new standards in new construction. These standards include:

(1) 49 CFR 192, Transportation of Natural and Other gas by pipeline; and
(2) 49 CFR 195, Transmission of Liquids by pipeline.

(F) Pipeline Safety Standards. The Lessee shall meet, where applicable, the safety standards and reporting requirements set forth in the following, as now in effect and as hereafter amended, or, if these regulations should be superseded, the regulations or other rules superseding them:

(1) 49 CFR, Part 190, Interim Minimum Federal Safety Standards;
(2) 49 CFR, Part 191, Report of Leaks;
(3) 49 CFR, Part 192, Transportation of Natural and Other Gas and Water;
(4) 49 CFR, Part 195, Transmission of Liquids by pipeline;

(G) Shut-Off Valves. The Lessee shall ensure that oil transportation pipeline designs provide for automatic shut-off valves at each pumping or compressor station and such additional valves as may be necessary in view of:

(1) Terrain and drainage systems traversed,
(2) Population centers,
(3) Wildlife and fishery habitat,
(4) Public water supplies and significant water bodies,
(5) Hazardous geologic areas, and
(6) Scenic Values.

The Lessee shall install any additional valves required by the Mining Supervisor.

(H) Pipeline Corrosion. With regard to oil transportation pipelines, the Lessee shall submit detailed plans to the Mining Supervisor for corrosion-resistant design and methods for early detection of pipeline corrosion. These shall include:

(1) Pipe material and welding techniques to be used and information on their particular suitability for the environment involved;

(2) Details on the external pipe protection to be provided (coating, wrapping, etc.), including information on variation of the coating process to cope with variations in environmental factors;

(3) Plans for cathodic protection including details of impressed ground sources and controls to ensure continuous maintenance of adequate protection over the entire surface of the pipe;

(4) Details of plans for monitoring cathodic protection current including spacing of current monitors; and

(5) Provision of periodic surveys of trouble spots, regular preventive maintenance surveys, regular surveys for external and internal deterioration which may result in failure, and special provisions for abnormal potential patterns resulting from crossings with other pipelines or cables.

(I) Electric Transmission Facilities. The Lessee shall design and construct telegraph, telephone, electric powerlines, distribution lines and other transmission facilities in accordance with the guidelines set forth in "environmental criteria for electric transmission system" (USDI, USDA, 1970), as now or in the future amended, or if these guidelines should be superseded, in the guidelines or other rules superseding them. Distribution lines shall be designed and constructed in accordance with REA Bulletin 61-10 (Powerline contacts by Eagles and other Large Birds), as now or in the future amended, or, if these guidelines should be superseded, in the guidelines or other rules superseding them.

(J) Natural Barriers. Where a road or exploratory site cuts a natural barrier used for livestock control, the Lessee shall, at his own expense, close the opening by the use of a fence or other suitable barrier meeting Bureau Standards.

(K) Specifications for Fences, and Cattleguards. Fences and cattleguards constructed by the Lessee shall meet established Bureau specifications and standards.

(L) Crossings. The Lessee shall take all steps necessary to make certain that roads constructed under this lease do not prevent or unreasonably disrupt the use of existing roads, foot trails, pipelines, and other right-of-way or major animal migration routes. This requirement shall include the construction of suitable overhead or underground crossings where they are determined to be necessary by the Mining Supervisor.

(M) Alternate Routes. If during construction the Lessee's activities shall interfere with the free use of existing roads and trails used by persons, whether or nor recorded, he shall provide such alternate roads and trails as the Mining Supervisor may determine to be needed.

(N) Off-Road Vehicle Use. The Lessee shall use off-road vehicles in a manner consistent with applicable regulations.

Section 3. FIRE PREVENTION AND CONTROL

(A) Instructions of the Mining Supervisor.

(1) The Lessee shall comply with the instructions and directions of the Mining Supervisor concerning the use, prevention and supression of fires, and shall make every reasonable effort to prevent, control and suppress any fire on land subject to the lease. Uncontrolled fires must be immediately reported to the Mining Supervisor.

(2) (a) The Lessee shall construct fire lines or perform clearing when determined by the Mining Supervisor to be necessary for forest, brush and grass fire prevention.

(b) The Lessee shall comply with the National Fire Codes on handling, transportation, storage, use and disposal of flammable liquids, gases, and solids.

(c) The Lessee shall take all appropriate actions to prevent oil shale outcrop fires.

(B) Liability of Lessee. The control and suppression of any fires on the leased lands (or on adjoining public lands which have spread from the leased lands) caused by the Lessee or his employees, contractors, subcontractors, or agents shall be at the expense of the Lessee. Upon the failure of the Lessee to control and suppress such fires in a manner satisfactory to him, the Mining Supervisor shall take such steps as are necessary to control and suppress the fire, either alone or in conjunction with other Federal, State, and local authorities, and the cost of such control and suppression shall be borne by the Lessee.

Section 4. HABITAT MANAGEMENT

(A) Exploration Period. The Lessee will submit, as part of the exploration plan, a vegetation plan for all areas to be disturbed during the exploration period. Prior to any disturbance, the Mining Supervisor will approve any necessary mitigation measures.

(B) Development Period. The Lessee shall submit for approval by the Mining Supervisor, as a part of the detailed development plan, a habitat management plan which shall include the steps which the Lessee shall take to:

(1) Avoid or, where avoidance is impracticable, minimize damage to fish and wildlife habitat, including water supplies;

(2) Restore such habitat in the event it is unavoidably destroyed or damaged;

(3) Provide alternate habitats; and

(4) Provide controlled access to the public for the enjoyment of the wildlife resources on such lands as may be mutually agreed upon. The plan shall include, but not be limited to, detailed information on activities, time schedule, performance standards, proposed accomplishments, and ways and means of avoiding or minimizing environmental impacts of fish and wildlife.

(C) Mitigation of Damage. Wherever destruction or significant disturbance of fish and wildlife habitat, not foreseen in the detailed development plan, will or does occur, the Lessee shall submit, for the Mining Supervisor's approval at least 60 days prior to the destruction or damage of the habitat, those measures which the Lessee proposes to take to comply with the requirement of 30 CFR 231.4(b), as now in effect or as hereafter amended or, if that regulation should be superseded, the regulation of other rules superseding it, to avoid, or where avoidance is impracticable, minimize and repair, injury or destruction of fish and wildlife and their habitat. As a general rule, the proposed measures should provide for habitat of similar type and equal in quantity and quality to that destroyed or damaged. The Mining Supervisor shall, within 60 days after the submission of the proposed measures to him, either approve or disapprove them. If he shall approve them, the Lessee shall execute the proposed measures for the mitigation of the destruction or damage of the habitat. If the Mining Supervisor shall disapprove the measures, he shall offer the Lessee an opportunity for consultation at which, whenever possible, he shall inform the Lessee of any changes which will make the measures acceptable.

(D) Big Game. The Lessee shall construct big game drift fences when and where necessary to direct big game movement around or away from oil shale development areas.

(E) Posting of Notices. The Lessee shall post in reasonable and conspicuous places notices informing its employees, agents, contractors, subcontractors, and their employees of all applicable laws and regulations governing hunting, fishing, and trapping.

Section 5. HEALTH AND SAFETY

(A) In General. The Lessee shall take all measures necessary to protect the Health and Safety of all persons affected by its activities and operations and shall immediately abate any activity or condition which threatens the life of any person or which threatens any person with bodily harm.

(B) Compliance with Federal Health and Safety Laws and Regulations. The Lessee shall comply with the Federal Metal and Non-metallic Mine Safety Act of 1966 (30 U.S.C. 721-740), as now in effect or as hereafter amended, or if it should be superseded, with the statute superseding it, and the Occupational Health and Safety Act of 1970 (29 U.S.C. 651-678), as now in effect, or as hereafter amended, or, if it should be superseded, with the statute superseding it, and all health and safety standards promulgated pursuant thereto.

(C) Use of Explosives. The Lessee shall ensure that all blasting operations, including the purchase, handling, transportation, storage, use, and destruction of blasting agents are performed in conformance with Public Law 91-452, October 15, 1970 (18 U.S.C. 88841-848), as now in effect or as hereafter amended, or if it should be superseded, with the statute superseding it, and the regulations promulgated thereunder which are now in 26 CFR 181.

Section 6. HISTORIC AND SCIENTIFIC VALUES

(A) Cultural Resources.

(1) Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource field inventory in a manner specified by the Mining Supervisor on portions of the area that may be adversely affected by lease-related activities and which were not previously inventoried. The inventory shall be conducted by a qualified professional cultural resource specialist (i.e. archaeologist, historian, or historical architect, as appropriate), approved by the Mining Supervisor. A report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Mining Supervisor. The Lessee shall undertake measures, in accordance with instructions, from the Mining Supervisor, to protect cultural resources on the leased lands. The lessee shall not commence the surface disturbing activities until permission to proceed is given by the Mining Supervisor.

(2) The lessee shall protect all known cultural resource properties within the lease area from lease-related activities until the cultural resource mitigation measures can be implemented as part of the detailed development plan.

(3) The cost of conducting the preparing reports, and carrying out inventory preparing reports, and carrying out mitigation measures shall be borne by the lessee.

(4) If cultural resources are discovered during operations under this lease, the lessee shall immediately bring them to the attention of the Mining Supervisor. The lessee shall not disturb such resources, except as may be subsequently authorized by the Mining Supervisor. As soon as practicable, the Mining Supervisor will evaluate or have evaluated any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the lessee.

(B) Paleontological Resources.

(1) Before undertaking any activities that may disturb the surface of the leased lands, the Lessee shall contact the Mining Supervisor to determine whether the lessee will be required to conduct a paleontological appraisal of the mine plan and adjacent areas, or exploration plan areas, that may be adversely affected by lease-related activities. If it is determined that one is necessary, the paleontological appraisal shall be conducted by a qualified paleontologist approved by the Mining Supervisor using published literature and, where appropriate, the field appraisals for determining the possible existence of fossils of scientific significance. A report of the appraisal and recommendations for protecting any fossils of significant scientific interest on the leased lands so identified shall be submitted to the Mining Supervisor. When necessary to protect and collect the fossils of significant scientific interest on the leased lands, the lessee shall undertake the measures provided in the approval of the mining and reclamation plan or exploration plan.

(2) The lessee shall not knowingly disturb, alter, destroy or take any fossils of significant scientific interest, and shall protect all such fossils in conformance with the measures included in the approval of the detailed development plan or exploration plan.

(3) The Lessee shall immediately bring any such fossils that might be altered or destroyed by his operations to the attention of the Mining Supervisor. Operations may continue as long as the fossil specimen or specimens would not be seriously damaged or destroyed by the activity. The Mining Supervisor shall evaluate or have evaluated such discoveries brought to his attention as soon as possible and shall notify the lessee as to what action shall be taken with respect to such discoveries.

(4) All such fossils of significant scientific interest shall remain under the jurisdiction of the United States. Copies of all paleontological resource data generated as a result of the lease term requirements will be provided to the Mining Supervisor.

(5) The cost of any required salvage of such fossils shall be borne by the Lessee.

(6) These conditions apply to all such fossils of significant scientific interest discovered within the lease area whether discovered in the overburden, interburden, or any mining zone.

Section 7. OIL AND HAZARDOUS MATERIALS

(A) Spill Contingency Plans. The Lessee agrees to submit spill contingency plans to the Mining Supervisor with the detailed development plan. This plan shall provide for the control of spills of oil or other hazardous substances which for purposes of this section 7 shall be defined in section 311(a)(14) of the Federal Water Pollution Control Act, as amended (86 Stat. 816, 863), as now in effect of as hereafter amended, or if it should be superseded, the statute superseding it.

The plans shall conform to this stipulation and the National Oil and Hazardous Substances Pollution Contingency Plan, 36 FR 16215, August 20, 1971, as now in force or as hereafter amended, or, if it shall be superseded, the document superseding it, and shall: (1) include a description of positive spill prevention efforts which the Lessee shall make; (2) include provisions for spill control; (3) provide for immediate corrective action including spill control and restoration of the affected resource; (4) provide that the Mining Supervisor shall approve any material or devices used for spill control and shall approve any disposal sites or techniques selected to handle spilled matter; and (5) include separate and specific techniques and schedules for cleaning of spills on land, rivers, and streams. As used in this stipulation, spill control is defined as including detection, location, confinement, and cleanup of the spill.

(B) Responsibility. If, during mining operations, any oil or other hazardous substance should be discharged, the control, removal, disposal, and cleanup of that substance, wherever found, shall be the responsibility of lessee. Upon the failure of the lessee to control, remove, dispose of, or clean up the discharge, or to repair all damages resulting therefrom, the Mining Supervisor may take such measures as he deems necessary to control, remove, dispose of, or clean up the discharge and restore the area, including, where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the lessee. Such action by the Mining Supervisor shall not relieve lessee of any responsibility as provided in this lease.

(C) Reporting of Spills and Discharges. The lessee shall give immediate notice of any spills or discharges of oil or other hazardous substances to: (1) the Mining Supervisor and (2) such other federal and state officials as are required by law to be given such notice. Any oral notice shall be confirmed by the lessee in writing as soon as possible.

(D) Storage and Handling. The lessee shall store oil, petroleum products, industrial chemicals and similar toxic or volatile materials in durable containers and locate such materials so that any accidental spillage will not drain into water courses, lakes, reservoirs, or groundwater. Unless otherwise approved by the Mining Supervisor, the lessee shall store substantial quantities (more than 500 gallons) of such materials in an area surrounded by impermeable containment structures. The volume of the containment structures shall be at least: (1) one-hundred ten (110) percent of the largest tank plus displacement of all other tanks in the compound below the dike height or liquid level; plus (2) a volume sufficient for maximum trapped precipitation and run-off which might be impounded at the time of a spill. The earthen dike must have a flat surface three feet wide on top of the dike.

(E) Pesticides and Herbicides. The Lessee shall not use pesticides and herbicides without the approval of the Mining Supervisor. Pesticides and herbicides shall be considered treatments of last resort, to be used only when reasonable alternatives are not available and where their use is consistent with protection and enhancement of the environment. Where pesticides and herbicides are used, they shall be used only with the approval of the Mining Supervisor and the type, amount, method of application, storage, and disposal shall be in accordance with applicable federal and state procedures.

Section 8. POLLUTION--AIR

(A) Air Quality. At all times during construction and operation, lessee shall conduct its activities in accordance with all applicable air quality standards and related plans of implementation adopted pursuant to the Clean Air Act, as amended (40 U.S.C. (1857-1857-1), as now in effect or as hereafter amended, or if it should be superseded, the statute superseding it, and applicable state standards. Further, the Lessee shall submit an air quality control program for approval of the Mining Supervisor as part of the detailed development plan. The program shall include descriptions of emission sources and concentrations, treatment facilities and operations, and the results of emission modeling.

(B) Dust. The Lessee shall make every reasonable effort to avoid, or, where avoidance is impracticable, minimize dust problems. Where necessary, sprinkling, oiling, or other means of dust control shall be required on roads and trails. The lessee shall conduct processing operations so as not to create environmental or health problems associated with dust.

(C) Burning. The Lessee shall not burn waste, timber, or debris, except when disposal is essential and other methods of disposal would be more harmful to the environment and when authorized by the Mining Supervisor.

Section 9. POLLUTION--WATER

(A) Water Quality. At all times during construction and operation, lessee shall conduct its activities in accordance with all applicable Federal and State water standards and related plans of implementation, as then in force. Where applicable federal and state standards do not exist, the Mining Supervisor may establish reasonable standards to prevent degradation of water, and the lessee shall comply with those standards. The lessee shall not discharge waste water into any aquifer deemed by the Mining Supervisor to be a potentially valuable water supply nor into any aquifer which will discharge the waste into a surface stream.

(B) Disturbance of Existing Waters. All construction activities, exclusive of actual mining activities, that may cause the creation of new lakes, drainages of existing ponds, diversion of natural drainages, alteration of stream hydraulics, disturbance of areas of stream beds or degradation of land and water quality or adversely affect the environmental integrity of the area prohibited unless approved in writing by the Mining Supervisor.

(C) Control of Waste Waters. In areas where overburden, water, or waste from mines or processing plants might contain toxic or saline materials, the Lessee shall:

(1) Divert surface or groundwater so as to avoid the formation of toxic and saline water and its drainage into streams, or, where avoidance is impracticable, to minimize the formation of such waters and drainage, by preventing the entry or reducing the flow of water into the workings, waste piles, or overburden-storage areas;

(2) Dispose of refuse and spent shale from mining and processing in a manner which will avoid the discharge of toxic drainage or saline water into surface or groundwater;

(3) Employ, upon termination of operations or use of any mine, processing plant, or waste disposal site, all practicable closing measures consistent with ecological principles and safety requirements in order to avoid the formation and discharge of toxic or saline water;

(4) Dispose of toxic and saline water derived from mining, processing, or refining operations in a manner that does not pollute surface or groundwaters;

(5) During mining operations, monitor spoil and refuse for the presence of materials likely to yield unacceptable alkaline, acidic, saline, or toxic solutes; and

(6) Reinject no water, except in compliance with Federal and State standards then in effect and where authorized to do so by the Mining Supervisor; if the Lessee does reinject water, he shall establish such monitoring as the Mining Supervisor shall require.

(D) Cuts and Fills. The Lessee shall not cut or fill near or in streams which will result in siltation or accumulation of debris unless approved in writing by the Mining Supervisor.

(E) Crossings. The location of crossings of perennial streams, lakes, and rivers must be approved in writing by the Mining Supervisor. To control erosion, the Lessee shall maintain buffer strips at least 200 feet wide on each side of such a stream in their natural and undisturbed state unless otherwise authorized in writing by the Mining Supervisor.

(F) Road Surfacing Materials. The type of road surfacing materials used by the Lessee must be approved by the Mining Supervisor.

(G) Water Management Plan. The Lessee shall submit a water management program for approval of the Mining Supervisor as part of the detailed development plan. The program shall include hydrologic monitoring during all phases of development, operations, and abandonment, and shall address descriptions of water handling facilities, surface flow diversion and augmentation, dams, impoundments, seepage control, treatment facilities, and groundwater control in the vicinity of mine workings, in-situ retorts and surface waste disposal areas. A contingency plan shall be included for excess surface and groundwater flow. Impoundments for storage and treament of poor quality water shall be constructed to prevent contamination of ground or surface water. The plan shall include best available information on the source, storage, and disposal of all water, and related estimates of water quantity and quality.

Section 10. POLLUTION--NOISE

The Lessee shall comply with all applicable Federal and State standards on noise pollution, as now in effect or as hereafter amended, or, if they should be superseded, the standards superseding them. In the absence of specific noise pollution standards, the Lessee shall keep noise at or below levels safe and acceptable for humans, as determined by the Mining Supervisor.

Section 11. REHABILITATION

(A) In General. The Lessee shall, in accordance with approved plans, rehabilitate all affected lands to a usable and productive condition consistent with or equal to pre-existing land uses in the area and compatible with existing, adjacent undisturbed natural areas, or in accord with future planned use as determined by the surface managing agency at the time the detailed development plan is prepared by the lessee. Rehabilitation methods include, but are not limited to the following: leveling, backfilling, compaction, covering the surface with topsoil, and revegetating the spoil banks and pit areas consistent with sound restoration methods. The Lessee shall leave reclaimed land in a usable, non-hazardous condition such that soil erosion and water pollution are avoided or minimized. The Lessee shall, to the extent practicable, conduct such backfilling, compaction, leveling, and grading concurrently with the mining operations. Upon removal of property at termination of the lease pursuant to sections 31 and 32 of the lease, the Lessee shall, in accordance with approved plans, complete the restoration of affected lands to a usable and productive condition consistent with or equal to pre- existing land uses in the area and compatible with existing adjacent undisturbed natural areas or to a condition determined by the surface managing agency.

(B) Management Plan. The Lessee shall submit for approval by the Mining Supervisor an erosion control and surface rehabilitation plan as part of any

exploration or development plan. The initial plan shall be submitted not less than 60 days prior to start of mining site preparation and updated each year thereafter before March 15. The plan shall include, but not be limited to, detailed information on activities, areas, time schedules, standards, accomplishments, methods of eliminating or minimizing oil shale development impacts, and preserving existing topsoil-like material. The Lessee shall base erosion control plans and procedures on a maximum 100-year precipitation rate characteristic of the area. If a 100-year rate is not available the Lessee shall use data based on the longest period of reliable information. Procedures and plans shall consider flash flood effects, mud flows, mudslides, landslides, rock falls, and other similar types of material mass movement.

(C) Stabilization of Disturbed Areas. The Lessee shall leave all disturbed areas in a stabilized condition. Stabilization practices shall include, as determined by the needs of specific sites: seeding; planting; mulching; and the placement of mat binders, soil binders, rock and gravel blankets or other such structures. Seeding and planting shall be repeated as often as the Mining Supervisor shall deem reasonable, if prior attempts to revegetate are unsuccessful. All trees, snags, stumps or other vegetative material, not having commercial, ecological, wildlife, or construction value, shall be considered for mechanical chipping and spreading in a manner that will aid seeding establishment and soil stabilization or handled in a manner approved by the Mining Supervisor.

(D) Surface Disturbance On-Site. The Lessee shall correct surface disturbance which may induce soil movement or water pollution, or both, whether during or after construction or mining, in accordance with the surface rehabilitation plan. Wherever possible, slopes shall be maintained or constructed at as low an angle as possible to facilitate revegetation.

(E) Areas of Unstable Soils. The Lessee shall, where possible, avoid areas having soils that are susceptible to slides and slips, excessive settlement, severe erosion and soil creep during construction or operation. When such areas can not be avoided the Lessee shall design construction to ensure maximum stability. The Lessee shall make soil foundation investigations in conjunction with construction activities. The Lessee shall make such data available to the Mining Supervisor upon request.

(F) Materials. The Lessee shall, when feasible, utilize waste rock from the mining operations for road beds, fills and other similar construction purposes. When not feasible, gravel and other construction materials shall be purchased in accordance with 43 CFR 3610, as now in effect or as here after amended, or, if it shall be superseded, the regulation or rule superseding it, except that the sale of such materials from stream beds and upland soil areas shall be avoided unless otherwise approved by the Bureau District Manager.

(G) Slopes of Cut and Fill Areas. To the extent consistent with good mining practice, the Lessee shall maintain all cut and fill slopes in a stable condition for the duration of the lease.

(H) Impoundments. The Lessee shall establish safe access to permanent water impoundments for persons, livestock, and wildlife, but, where consumption of such water would be harmful to humans or to use of such water would be detrimental to animals, he shall take necessary steps to prevent access by those to whom it would be harmful or detrimental.

(I) Floodplains. The Lessee shall not construct improvements or conduct operations in floodplains or stream drainages when it is reasonable to expect risk to human life, pollution damage, or destruction of the existing environment caused by flood damage, without the express permission of the Mining Supervisor and without providing for protection of any such improvement constructed.

(J) Land Reclamation. The Lessee shall, unless otherwise directed by the Mining Supervisor, backfill, compact, level, final grade, cover with topsoil or topsoil-like material and initiate revegetation of each segment of the operation area in accordance with the rehabilitation plan as soon as that segment is no longer needed, but not later than one year after completion of the particular operation, unless an alternative schedule has been approved by the Mining Supervisor. Slopes to be revegetated shall be constructed at as low an angle as possible. Special attention shall be given to minimize deleterious hydrologic effects.

(K) Overburden. The Lessee shall, unless otherwise directed by the Mining Supervisor, separate overburden material and stockpile it separately as to topsoil, and rock material for later use as fill and as top dressing for rehabilitation of disturbed areas.

(L) Revegetation.

(1) The Lessee shall revegetate all portions of the leased lands which have been disturbed by his operations as soon as possible after the disturbance has ended in order to prevent, or, if prevention is impracticable, to minimize erosion and related problems. The Lessee shall restore the vegetation of disturbed areas by reestablishing permanent vegetation of a quality which will support fauna of the same kinds and in the same numbers as those existing at the time the environmental data was obtained under section 1 (C) of these stipulations. Plans for revegetation, including species, density, and timing, must be submitted to the Mining Supervisor for approval. The Mining Supervisor may require any reasonable methods of revegetation, and, if he deems it desirable, may require the Lessee to fence areas to assist revegetation. However, if the Lessor determines, at the time of submission of the detailed development plan under section 10(A) of this lease, that the leased lands will, upon the termination of the lease, be put to a different use from that to which they were devoted immediately prior to the issuance of this lease, the Mining Supervisor may require the Lessee to revegetate the land to meet that objective, except that the Lessee shall not be required to expend more money than that needed to meet the first revegetation standard.

(2) The Lessee shall initiate a revegetation program approved by the Mining Supervisor (with concurrence of BLM) at the start of production to (1) delineate those parameters necessary to establish vegetation at a specific location and show that successful changes in vegetation are compatible with the requirements under subparagraph (1) above.

(3) The Lessee shall demonstrate at the time of submission of the detailed development plan under section 10(a) of this lease that revegetation technology is available to enable him to provide the revegetation of the disturbed areas which is required under paragraph (1) of this subsection. If, in the

opinion of the Mining Supervisor, the Lessee has failed to demonstrate the required technology, he shall be required to submit for approval a program designed to obtain the required technology. If the program to obtain the necessary technology is satisfactory, the Mining Supervisor may approve the Lessee's development plan submitted under section 10(a), but, if the Lessee has not demonstrated the necessary technology by the tenth Anniversary Date after the Lease Year in which the development plan under section 10(a) was approved, the Lessee shall cease all exploratory, development, and production operations under that plan until he has demonstrated that the necessary technology is available to him. The Lessee shall report annually to the Mining Supervisor on the progress of this approved program to obtain the required technology. If the progress appears inadequate at any time, the Mining Supervisor may request the Lessee to amend the program. Whenever the Lessee has demonstrated the necessary technology, the required program shall terminate. Where the Mining Supervisor finds the Lessee has conducted his program to obtain technology, including any requested amendments, in a diligent manner and has expended funds in excess of $500,000 of that program, the Secretary may determine the expenditures in excess of that figure to be extraordinary costs within the terms of section 7(D) of the lease and may credit those excess expenditures against any present or future royalties due the Lessor, provided the results of the program are made public.

## Section 12. SCENIC VALUES

(A) Scenic Considerations in General. The Lessee shall, except where the Mining Supervisor has approved otherwise, use the following standards in all designing, clearing, earthmoving, and construction:

(1) Contours compatible with the natural environment shall be used to avoid straight lines.

(2) Natural colors consistent with the local environment such as pastels or muted shades of brown, green, reds, or greys shall be used in painting of facilities installed on the lease. Bright or unnatural colors shall be avoided except for use in warning signs or signals.

(3) Small natural openings or the edges of larger openings in the natural environment shall be utilized in construction of facilities, or disturbing the land surface.

(4) During the time when the land is disturbed, the portion of land which is not under revegetation programs shall only be those areas required under the mining plan for mining, storage, processing, or disposal operations and related facilities.

(5) Contouring of the disturbed area for reclamation shall simulate natural opening or areas consistent with the surrounding topography.

(B) Consideration of Aesthetic Values. The Lessee shall consider existing aesthetic values in all planning, construction, reclamation and mining operations. All operations, including, but not limited to, design and construction of roads, pipelines and transmission lines, shall, where practicable, be performed so as to minimize visual impact, make use of the natural topography, and to achieve harmony with the landscape.

(C) Protection of Landscape. The Lessee shall design any structures and facilities built under this lease so that they will, to the extent practicable, blend with the natural landscape.

(D) Signs. The Lessee shall design and construct signs that are rustic in appearance and to conform to BLM sign standards.

Section 13. VEGETATION

(A) In General.

(1) The Lessee shall reserve from cutting and removal all timber and other vegetative material outside the clearing boundaries and all blazed, painted or posted trees which are on or mark the clearing boundaries, with the exception of dangerous trees or snags designated as such by the Mining Supervisor.

(2) The Lessee shall ensure that all trees, snags or other woody material cut in connection with clearing operations are felled into the right-of-way and away from live water courses.

(B) Timber. The Lessee shall deal with timber in accordance with the following: clearing and grubbing limits shall be approximately 5 ft. outside of the edge of any cut or fill; where practicable, trees, snags, stumps or other woody material not having wildlife value or value to the Lessee shall be mechanically chipped and spread in a manner that will aid seeding establishment and soil stabilization or handled in a manner approved by the Mining Supervisor; clearing boundaries shall be identified on the ground prior to clearing operations.

(C) Clearing and Stripping. The Lessee may clear and strip only such land as is necessary for mining, processing, disposal, and other operations under the lease. In connection with such operations the Lessee may clear and strip land necessary for roadbeds, but such roadbed widths shall be not more than 25 feet from the centerline, unless specified by the Mining Supervisor.

Section 14. WASTE DISPOSAL

(A) Mine Waste. The Lessee shall, in accordance with the detailed development plan under section 10(a) of this lease, backfill or reclaim excavated material and spent shale and shall compact it thoroughly by machinery to avoid or, where avoidance is impossible, minimize erosion. The Lessee shall design slope faces of waste piles to ensure slope stability and shall revegetate slope faces in accordance with the rehabilitation plan.

(B) Other Disposal Areas. The term "waste" as used in this subsection (B) means all waste other than mine waste. In accordance with approved plans, the Lessee shall collect, recycle or dispose of waste in sanitary land fills or other disposal areas, and shall use the best practicable portable or permanent waste disposal systems as approved by the Mining Supervisor. The Lessee shall remove or otherwise dispose of all waste in a manner acceptable to the Mining Supervisor, and in accordance with all applicable standards and guidelines of the state, the United States Public Health Service and the Environmental Protection Agency.

(C) Disposal of Solid and Liquid Wastes. The Lessee shall design and construct disposal systems for solid and liquid wastes so as to avoid landslides, control erosion by wind and water, and establish conditions conducive to vegetative growth in the disposal area. The Lessee shall select and prepare disposal sites for wastes so as to avoid downward percolation of leached products and other pollutants in aquifers.

(D) Impoundment of Water. No disposal of mine waste, other waste, or the residue from any activity under this lease shall be disposed of in a manner which could cause an impoundment of water unless plans for spillways and means of diversion and the prevention of both surface and underground water contamination have been prepared by the Lessee and approved by the Mining Supervisor, and the Lessee has complied with those plans.

(E) Slurry Waste Disposal. Whenever slurry waste disposal is used the Lessee shall provide impoundments sufficient to contain landslides, mud flows, or waste pile blowouts.

Section 15. SOCIOECONOMICS AND OFF-SITE TRANSPORTATION

The lessee is required to consult with affected state and local governments in addressing social, economic and transportation impacts. The following is provided as a means to assist state and local government agencies in predicting, planning and mitigating these impacts.

(A) Socioeconomic and Transportation Report. The lessee shall prepare and submit a report to the Mining Supervisor together with the Detailed Development Plan required in Section 10 (a) of the lease. In preparing this report, the lessee may supplement site-specific data with data compiled by others. This report will consist of:

(1) A summary description of existing social and economic conditions, and existing off-site transportation systems and capacities;

(2) The estimated number of employees the specific lease operation will require during each phase of construction, mining and processing on the leased lands; the estimated multiplied population attendant to that employment; and where that population is anticipated to reside;

(3) Based on information acquired in consultation with state and local government, an analysis of the estimated effect of that population influx upon the county and community infrastructure;

(4) A statement of the immediate impacts and long-term effects of construction, mining and processing on the leased lands to tranportation facilities within the state;

(5) A statement of mitigation measures or opportunities which could be implemented to assist in dealing with these impacts; and

(6) A statement of the perceived roles and responsibilities of the lessee, the affected local governments, and the State of Colorado, relating to the technical and financial needs of the affected communities.

The lessee shall consult with affected local government agencies to determine the most appropriate elements to be included in the Socioeconomic and Transportation Report. In addition, the lessee will provide to the Mining Supervisor other available plans and projections that could be beneficial to planners in health, education, transportation, housing, recreation, and public and social services. The Lessee shall maintain records of information obtained and shall submit to the Mining Supervisor a status report of the socioeconomic and transportation conditions as part of the annual progress report required under Section 10(c) of the Lease. The Mining Supervisor shall make this data available to concerned government agencies.

(B) Community Affairs. The lessee shall designate an individual to work directly with the appropriate Federal, State and local authorities. This official will maintain communication with planning personnel in order to inform them of the Lessees' plans and activities, and assist in providing technical services for planning, as required. The Lessees' efforts shall be directed toward cooperation with and assistance to local and regional entities in alleviating socioeconomic and transportation impacts and assuring a well ordered community development process.

# APPENDIX B

## SOCIAL

# LIST OF APPENDIX TABLES

TABLE B-1
TOTAL COMMUNITY POPULATION IMPACTS - BY YEARS, 1985-1993
LOW PRODUCTION LEVEL - ONE TRACT

| | Silt/ New Castle | Rifle | Parachute/ Battlement Mesa | Glenwood/ Carbondale | Total Garfield County | Rangely | Meeker | Total Rio Blanco County | Grand Junction |
|---|---|---|---|---|---|---|---|---|---|
| 1985 Construction | 17 | 318 | 10 | 0 | 345 | 46 | 216 | 262 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 363 | 0 | 80 | 443 | 40 | 171 | 211 | |
| Total | 17 | 681 | 10 | 80 | 788 | 86 | 387 | 473 | |
| 1986 Construction | 39 | 721 | 24 | 0 | 784 | 91 | 431 | 522 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 667 | 0 | 146 | 813 | 81 | 346 | 427 | |
| Total | 39 | 1,388 | 24 | 146 | 1,597 | 172 | 777 | 949 | |
| 1987 Construction | 59 | 1,087 | 35 | 0 | 1,181 | 136 | 642 | 778 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 1,023 | 0 | 225 | 1,248 | 124 | 526 | 650 | |
| Total | 59 | 2,110 | 35 | 225 | 2,429 | 260 | 1,168 | 1,428 | |
| 1988 BASELINE | 5,100 | 11,300 | 8,100 | 15,800 | 40,300 | 4,200 | 5,800 | 10,000 | 78,500 |
| 1988 Construction | 78 | 1,429 | 46 | 0 | 1,553 | 207 | 976 | 1,183 | |
| Operations | 11 | 201 | 7 | 0 | 219 | 31 | 145 | 176 | |
| Non-Basic | 0 | 1,524 | 0 | 335 | 1,859 | 148 | 630 | 778 | 100 |
| Total | 89 | 3,154 | 53 | 335 | 3,631 | 386 | 1,751 | 2,137 | |
| 1989 Construction | 61 | 1,129 | 37 | 0 | 1,227 | 142 | 667 | 809 | |
| Operations | 22 | 397 | 13 | 0 | 432 | 49 | 232 | 281 | |
| Non-Basic | 0 | 1,406 | 0 | 309 | 1,715 | 169 | 720 | 889 | |
| Total | 83 | 2,932 | 50 | 309 | 3,374 | 360 | 1,619 | 1,979 | |
| 1990 Construction | 45 | 834 | 28 | 0 | 907 | 104 | 493 | 597 | |
| Operation | 32 | 584 | 19 | 0 | 635 | 72 | 342 | 414 | |
| Non-Basic | 0 | 1,284 | 0 | 282 | 1,566 | 154 | 657 | 811 | |
| Total | 77 | 2,702 | 47 | 282 | 3,108 | 330 | 1,492 | 1,822 | |
| 1991 Construction | 30 | 547 | 18 | 0 | 595 | 69 | 323 | 392 | |
| Operations | 41 | 762 | 25 | 0 | 828 | 94 | 445 | 539 | |
| Non-Basic | 0 | 1,160 | 0 | 255 | 1,415 | 138 | 589 | 727 | |
| Total | 71 | 2,469 | 43 | 255 | 2,838 | 301 | 1,357 | 1,658 | |
| 1992 Construction | 15 | 269 | 8 | 0 | 292 | 34 | 159 | 193 | |
| Operations | 50 | 926 | 31 | 0 | 1,007 | 115 | 541 | 656 | |
| Non-Basic | 0 | 1,034 | 0 | 227 | 1,261 | 123 | 522 | 645 | |
| Total | 65 | 2,229 | 39 | 227 | 2,560 | 272 | 1,222 | 1,494 | |
| 1993 BASELINE | 4,900 | 10,000 | 7,800 | 15,100 | 37,800 | 4,000 | 5,500 | 9,500 | 80,200 |
| 1993 Construction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Operations | 59 | 1,078 | 35 | 0 | 1,172 | 134 | 633 | 767 | |
| Non-Basic | 0 | 902 | 0 | 198 | 1,100 | 107 | 455 | 562 | 400 |
| Total | 59 | 1,980 | 35 | 198 | 2,272 | 241 | 1,088 | 1,329 | |

TABLE B-2
TOTAL COMMUNITY POPULATION IMPACTS - BY YEARS, 1985-1993
HIGH PRODUCTION LEVEL - ONE TRACT

| | Silt/ New Castle | Rifle | Parachute/ Battlement Mesa | Glenwood/ Carbondale | Total Garfield County | Rangely | Meeker | Total Rio Blanco County | Grand Junction |
|---|---|---|---|---|---|---|---|---|---|
| 1985 Construction | 25 | 468 | 15 | 0 | 508 | 59 | 276 | 335 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 447 | 0 | 98 | 545 | 57 | 244 | 301 | |
| Total | 25 | 915 | 15 | 98 | 1,053 | 116 | 520 | 636 | |
| 1986 Construction | 51 | 933 | 30 | 0 | 1,014 | 117 | 554 | 671 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 906 | 0 | 199 | 1,105 | 114 | 487 | 601 | |
| Total | 51 | 1,839 | 30 | 199 | 2,119 | 231 | 1,041 | 1,272 | |
| 1987 Construction | 76 | 1,400 | 46 | 0 | 1,522 | 176 | 829 | 1,005 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 1,376 | 0 | 302 | 1,678 | 172 | 732 | 904 | |
| Total | 76 | 2,776 | 46 | 302 | 3,200 | 348 | 1,561 | 1,909 | |
| 1988 BASELINE | 5,100 | 11,300 | 10,300 | 15,800 | 42,500 | 5,000 | 6,200 | 11,200 | 81,600 |
| 1988 Construction | 100 | 1,847 | 60 | 0 | 2,007 | 232 | 1,094 | 1,326 | |
| Operations | 14 | 248 | 8 | 0 | 270 | 31 | 148 | 179 | |
| Non-Basic | 0 | 2,028 | 0 | 445 | 2,473 | 249 | 1,063 | 1,312 | 100 |
| Total | 114 | 4,123 | 68 | 445 | 4,750 | 512 | 2,305 | 2,817 | 100 |
| 1989 Construction | 79 | 1,459 | 48 | 0 | 1,586 | 183 | 863 | 1,046 | |
| Operations | 27 | 491 | 16 | 0 | 534 | 62 | 291 | 353 | |
| Non-Basic | 0 | 1,848 | 0 | 406 | 2,254 | 225 | 957 | 1,182 | |
| Total | 106 | 3,798 | 64 | 406 | 4,374 | 470 | 2,111 | 2,581 | |
| 1990 Construction | 59 | 1,078 | 35 | 0 | 1,172 | 135 | 639 | 774 | |
| Operation | 39 | 726 | 24 | 0 | 789 | 90 | 426 | 516 | |
| Non-Basic | 0 | 1,668 | 0 | 366 | 2,034 | 200 | 853 | 1,053 | |
| Total | 98 | 3,472 | 59 | 366 | 3,995 | 425 | 1,918 | 2,343 | |
| 1991 Construction | 39 | 708 | 23 | 0 | 770 | 89 | 418 | 507 | |
| Operations | 51 | 946 | 31 | 0 | 1,028 | 118 | 555 | 673 | |
| Non-Basic | 0 | 1,485 | 0 | 326 | 1,811 | 175 | 748 | 923 | |
| Total | 90 | 3,139 | 54 | 326 | 3,609 | 382 | 1,721 | 2,103 | |
| 1992 Construction | 19 | 349 | 11 | 0 | 379 | 44 | 205 | 249 | |
| Operations | 63 | 1,155 | 37 | 0 | 1,255 | 143 | 676 | 819 | |
| Non-Basic | 0 | 1,298 | 0 | 285 | 1,583 | 152 | 647 | 799 | |
| Total | 82 | 2,802 | 48 | 285 | 3,217 | 339 | 1,528 | 1,867 | |
| 1993 BASELINE | 5,000 | 12,400 | 12,500 | 15,100 | 45,000 | 4,900 | 6,200 | 11,100 | 86,700 |
| 1993 Construction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Operations | 73 | 1,344 | 44 | 0 | 1,461 | 167 | 785 | 952 | |
| Non-Basic | 0 | 1,115 | 0 | 245 | 1,360 | 128 | 545 | 673 | 500 |
| Total | 73 | 2,459 | 44 | 245 | 2,821 | 295 | 1,330 | 1,625 | 500 |

TABLE B-3
TOTAL COMUNITY POPULATION IMPACTS - BY YEARS, 1985-1993
LOW PRODUCTION LEVEL - BOTH TRACTS

| | Silt/ New Castle | Rifle | Parachute/ Battlement Mesa | Glenwood/ Carbondale | Total Garfield County | Rangely | Meeker | Total Rio Blanco County | Grand Junction |
|---|---|---|---|---|---|---|---|---|---|
| 1985 Construction | 34 | 636 | 40 | 0 | 690 | 92 | 432 | 524 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 726 | 0 | 160 | 886 | 80 | 342 | 422 | |
| Total | 34 | 1,362 | 40 | 160 | 1,576 | 172 | 774 | 946 | |
| 1986 Construction | 78 | 1,442 | 48 | 0 | 1,568 | 182 | 862 | 1,044 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 1,334 | 0 | 292 | 1,626 | 162 | 692 | 854 | |
| Total | 78 | 2,776 | 48 | 292 | 3,194 | 344 | 1,554 | 1,898 | |
| 1987 Construction | 118 | 2,174 | 70 | 0 | 2,362 | 272 | 1,284 | 1,556 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 2,046 | 0 | 450 | 2,496 | 248 | 1,052 | 1,300 | |
| Total | 118 | 4,220 | 70 | 450 | 4,858 | 520 | 2,336 | 2,856 | |
| 1988 BASELINE | 5,100 | 11,300 | 8,100 | 15,800 | 40,300 | 4,200 | 5,800 | 10,000 | 78,500 |
| 1988 Construction | 156 | 2,858 | 92 | 0 | 3,106 | 414 | 1,952 | 2,366 | |
| Operations | 22 | 402 | 14 | 0 | 438 | 62 | 290 | 352 | |
| Non-Basic | 0 | 3,048 | 0 | 670 | 3,718 | 296 | 1,260 | 1,556 | 200 |
| Total | 178 | 6,308 | 106 | 670 | 7,262 | 772 | 3,502 | 4,274 | 200 |
| 1989 Construction | 122 | 2,258 | 74 | 0 | 2,454 | 284 | 1,334 | 1,618 | |
| Operations | 44 | 794 | 26 | 0 | 864 | 98 | 464 | 562 | |
| Non-Basic | 0 | 2,812 | 0 | 618 | 3,430 | 338 | 1,440 | 1,778 | |
| Total | 166 | 5,864 | 100 | 618 | 6,748 | 720 | 3,238 | 3,958 | |
| 1990 Construction | 90 | 1,668 | 56 | 0 | 1,814 | 208 | 986 | 1,194 | |
| Operation | 64 | 1,168 | 38 | 0 | 1,270 | 144 | 684 | 828 | |
| Non-Basic | 0 | 2,568 | 0 | 564 | 3,132 | 308 | 1,314 | 1,622 | |
| Total | 154 | 5,404 | 94 | 564 | 6,216 | 660 | 2,984 | 3,644 | |
| 1991 Construction | 60 | 1,094 | 36 | 0 | 1,190 | 138 | 646 | 784 | |
| Operations | 82 | 1,524 | 50 | 0 | 1,656 | 188 | 890 | 1,078 | |
| Non-Basic | 0 | 2,320 | 0 | 510 | 2,830 | 276 | 1,178 | 1,454 | |
| Total | 142 | 4,938 | 86 | 510 | 5,676 | 602 | 2,714 | 3,316 | |
| 1992 Construction | 30 | 538 | 16 | 0 | 584 | 68 | 318 | 386 | |
| Operations | 100 | 1,852 | 62 | 0 | 2,014 | 230 | 1,082 | 1,312 | |
| Non-Basic | 0 | 2,068 | 0 | 454 | 2,522 | 246 | 1,044 | 1,290 | |
| Total | 130 | 4,458 | 78 | 454 | 5,120 | 544 | 2,444 | 2,988 | |
| 1993 BASELINE | 4,900 | 10,000 | 7,800 | 15,100 | 37,800 | 4,000 | 5,500 | 9,500 | 80,200 |
| 1993 Construction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Operations | 118 | 2,156 | 70 | 0 | 2,344 | 268 | 1,266 | 1,534 | |
| Non-Basic | 0 | 1,804 | 0 | 396 | 2,200 | 214 | 910 | 1,124 | 800 |
| Total | 118 | 3,960 | 70 | 396 | 4,544 | 482 | 2,176 | 2,658 | 800 |

TABLE B-4
TOTAL COMMUNITY POPULATION IMPACTS - BY YEARS, 1985-1993
HIGH PRODUCTION LEVEL - BOTH TRACTS

| | Silt/ New Castle | Rifle | Parachute/ Battlement Mesa | Glenwood/ Carbondale | Total Garfield County | Rangely | Meeker | Total Rio Blanco County | Grand Junction |
|---|---|---|---|---|---|---|---|---|---|
| 1985 Construction | 50 | 936 | 30 | 0 | 1,016 | 118 | 552 | 670 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 894 | 0 | 96 | 1,090 | 114 | 488 | 602 | |
| Total | 50 | 1,830 | 30 | 96 | 2,106 | 232 | 1,040 | 1,272 | |
| 1986 Construction | 102 | 1,866 | 60 | 0 | 2,028 | 234 | 1,108 | 1,342 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 1,812 | 0 | 398 | 2,210 | 228 | 974 | 1,202 | |
| Total | 102 | 3,678 | 60 | 398 | 4,238 | 462 | 2,082 | 2,544 | |
| 1987 Construction | 152 | 2,800 | 92 | 0 | 3,044 | 352 | 1,658 | 2,010 | |
| Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Non-Basic | 0 | 2,752 | 0 | 604 | 3,356 | 344 | 1,464 | 1,808 | |
| Total | 152 | 5,552 | 92 | 604 | 6,400 | 696 | 3,122 | 3,818 | |
| 1988 BASELINE | 5,100 | 11,300 | 10,300 | 15,800 | 42,500 | 5,000 | 6,200 | 11,200 | 81,600 |
| 1988 Construction | 200 | 3,694 | 120 | 0 | 4,014 | 464 | 2,188 | 2,652 | |
| Operations | 28 | 496 | 16 | 0 | 540 | 62 | 296 | 358 | |
| Non-Basic | 0 | 4,056 | 0 | 890 | 4,946 | 498 | 2,126 | 2,624 | 200 |
| Total | 228 | 8,246 | 136 | 890 | 9,500 | 1,024 | 4,610 | 5,634 | 200 |
| 1989 Construction | 158 | 2,918 | 96 | 0 | 3,172 | 366 | 1,726 | 2,092 | |
| Operations | 54 | 982 | 32 | 0 | 1,068 | 124 | 582 | 706 | |
| Non-Basic | 0 | 3,696 | 0 | 812 | 4,508 | 450 | 1,914 | 2,364 | |
| Total | 212 | 7,596 | 128 | 812 | 8,748 | 940 | 4,222 | 5,162 | |
| 1990 Construction | 118 | 2,156 | 70 | 0 | 2,344 | 270 | 1,278 | 1,548 | |
| Operation | 78 | 1,452 | 48 | 0 | 1,578 | 180 | 852 | 1,032 | |
| Non-Basic | 0 | 3,336 | 0 | 732 | 4,068 | 400 | 1,706 | 2,106 | |
| Total | 196 | 6,944 | 118 | 732 | 7,990 | 850 | 3,836 | 4,686 | |
| 1991 Construction | 78 | 1,416 | 46 | 0 | 1,540 | 178 | 836 | 1,014 | |
| Operations | 102 | 1,892 | 62 | 0 | 2,056 | 236 | 1,110 | 1,346 | |
| Non-Basic | 0 | 2,970 | 0 | 652 | 3,622 | 350 | 1,496 | 1,846 | |
| Total | 180 | 6,278 | 108 | 652 | 7,218 | 764 | 3,442 | 4,206 | |
| 1992 Construction | 38 | 698 | 22 | 0 | 758 | 88 | 410 | 498 | |
| Operations | 126 | 2,310 | 74 | 0 | 2,510 | 286 | 1,352 | 1,638 | |
| Non-Basic | 0 | 2,596 | 0 | 570 | 3,166 | 304 | 1,294 | 1,598 | |
| Total | 164 | 5,604 | 96 | 570 | 6,434 | 678 | 3,056 | 3,734 | |
| 1993 BASELINE | 5,000 | 12,400 | 12,500 | 15,100 | 45,000 | 4,900 | 6,200 | 11,100 | 86,700 |
| 1993 Construction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Operations | 146 | 2,688 | 88 | 0 | 2,922 | 334 | 1,570 | 1,904 | |
| Non-Basic | 0 | 2,230 | 0 | 490 | 2,720 | 256 | 1,090 | 1,346 | 1,000 |
| Total | 146 | 4,918 | 88 | 490 | 5,642 | 590 | 2,660 | 3,250 | 1,000 |

TABLE B-5
COMPARATIVE SOCIAL IMPACTS OF VARIOUS ALTERNATIVES ON COMMUNITIES,
PEAK AND FULL OPERATION STAGES (1988 AND 1993)

| | No Action | | Low Level Prod. C-18 Only | Low Level Prod. C-11 Only | High Level Prod. C-18 Only | High Level Prod. C-11 Only | Low Level Prod. Both Tracts | High Level Prod. Both Tracts |
|---|---|---|---|---|---|---|---|---|
| | High | Low | | | | | | |
| Silt/New Castle | | | | | | | | |
| 1988 | | | | | | | | |
| Baseline | 5,100 | 5,100* | 5,100 | 5,100 | 5,100 | 5,100 | 5,100 | 5,100 |
| Peak Impact | | | 89 | 89+** | 114 | 114+ | 178 | 228 |
| % Impact | | | 1.7 | 1.7+ | 2.2 | 2.2+ | 3.5 | 4.5 |
| 1993 | | | | | | | | |
| Baseline | 5,000 | 4,900* | 4,900 | 4,900 | 5,000 | 5,000 | 4,900 | 5,000 |
| Full Operation | | | 59 | 59+ | 73 | 73+ | 118 | 146 |
| % Impact | | | 1.2 | 1.2+ | 1.5 | 1.5+ | 2.4 | 2.9 |
| Rifle | | | | | | | | |
| 1988 | | | | | | | | |
| Baseline | 11,300 | 11,300* | 11,300 | 11,300 | 11,300 | 11,300 | 11,300 | 11,300 |
| Peak Impact | | | 3,154 | 3,154+ | 4,123 | 4,123+ | 6,308 | 8,246 |
| % Impact | | | 27.9 | 27.9+ | 36.5 | 36.5+ | 55.8 | 73.0 |
| 1993 | | | | | | | | |
| Baseline | 12,400 | 10,000* | 10,000 | 10,000 | 12,400 | 12,400 | 10,000 | 12,400 |
| Full Operation | | | 1,980 | 1,980+ | 2,459 | 2,459+ | 3,960 | 4,918 |
| % Impact | | | 19.8 | 19.8+ | 19.8 | 19.8+ | 39.6 | 39.7 |
| Parachute/Battlement | | | | | | | | |
| 1988 | | | | | | | | |
| Baseline | 10,300 | 8,100* | 8,100 | 8,100 | 10,300 | 10,300 | 8,100 | 10,300 |
| Peak Impact | | | 53 | 53+ | 68 | 68+ | 106 | 136 |
| % Impact | | | .7 | .7+ | .7 | .7+ | 1.3 | 1.3 |
| 1993 | | | | | | | | |
| Baseline | 12,500 | 7,800* | 7,800 | 7,800 | 12,500 | 12,500 | 7,800 | 12,500 |
| Full Operation | | | 35 | 35+ | 44 | 44+ | 70 | 88 |
| % Impact | | | .4 | .4+ | .4 | .4+ | .9 | .7 |
| Glenwood/Carbondale | | | | | | | | |
| 1988 | | | | | | | | |
| Baseline | 15,800 | 15,800* | 15,800 | 15,800 | 15,800 | 15,800 | 15,800 | 15,800 |
| Peak Impact | | | 335 | 335+ | 445 | 445+ | 670 | 890 |
| % Impact | | | 2.1 | 2.1+ | 2.8 | 2.8+ | 4.2 | 5.6 |
| 1993 | | | | | | | | |
| Baseline | 15,100 | 15,100* | 15,100 | 15,100 | 15,100 | 15,100 | 15,100 | 15,100 |
| Full Operation | | | 198 | 198+ | 245 | 245+ | 396 | 490 |
| % Impact | | | 1.3 | 1.3+ | 1.6 | 1.6+ | 2.6 | 3.2 |
| Rangely | | | | | | | | |
| 1988 | | | | | | | | |
| Baseline | 5,000 | 4,200 | 4,200 | 4,200 | 5,000 | 5,000 | 4,200 | 5,000 |
| Peak Impact | | | 386 | 386+ | 512 | 512+ | 772 | 1,024 |
| % Impact | | | 9.2 | 9.2+ | 10.2 | 10.2+ | 18.4 | 20.5 |
| 1993 | | | | | | | | |
| Baseline | 4,900 | 4,000 | 4,000 | 4,000 | 4,900 | 4,900 | 4,000 | 4,900 |
| Full Operation | | | 241 | 241+ | 295 | 295+ | 482 | 590 |
| % Impact | | | 6.0 | 6.0+ | 6.0 | 6.0+ | 12.0 | 12.0 |
| Meeker | | | | | | | | |
| 1988 | | | | | | | | |
| Baseline | 6,200 | 5,800 | 5,800 | 5,800 | 6,200 | 6,200 | 5,800 | 6,200 |
| Peak Impact | | | 1,751 | 1,751+ | 2,305 | 2,305+ | 3,502 | 4,610 |
| % Impact | | | 30.2 | 30.2+ | 37.2 | 37.2+ | 60.4 | 74.4 |
| 1993 | | | | | | | | |
| Baseline | 6,200 | 5,500 | 5,500 | 5,500 | 6,200 | 6,200 | 5,500 | 6,200 |
| Full Operation | | | 1,088 | 1,088+ | 1,330 | 1,330+ | 2,176 | 2,660 |
| % Impact | | | 19.8 | 19.8+ | 21.5 | 21.5+ | 39.6 | 42.9 |
| Grand Junction | | | | | | | | |
| 1988 | | | | | | | | |
| Baseline | 81,600 | 78,500* | 78,500 | 78,500 | 81,600 | 81,600 | 78,500 | 81,600 |
| Peak Impact | | | 100 | 100+ | 100 | 100+ | 200 | 200 |
| % Impact | | | .1 | .1+ | .1 | .1+ | .3 | .2 |
| 1993 | | | | | | | | |
| Baseline | 86,700 | 80,200* | 80,200 | 80,200 | 86,700 | 86,700 | 80,200 | 86,700 |
| Full Operation | | | 400 | 400+ | 500 | 500+ | 800 | 1,000 |
| % Impact | | | .5 | .5+ | .6 | .6+ | 1.0 | 1.2 |

* Population baseline projections were computed prior to close down of the Colony Oil Shale project in Parachute Canyon and cancellation of the La Sal Pipeline project. Therefore these estimates are much too high. Our deadlines did not allow re-calculations.

** The Multi-Mineral Corp. project on Tract C-18 is expected to proceed on schedule unless tract is leased, in which case this project would be absorbed into the C-18 development. Thus, if only C-11 is leased, the Multi-Mineral project would represent an additional impact in population which is not estimated here but which could amount to several hundred persons in the area.

# GLOSSARY

# GLOSSARY

**ACCIPETERS**. The family of long-tailed hawks with short, rounded wings; chiefly woodland birds that do not soar.

**ACTIVE NEST**. An active raptor nest is one which: (a) is known to have been used by nesting raptors in at least one of the three preceeding years, or (b) is in such condition that prior use by raptors can be verified, and little or no repair will be required for its subsequent use for nesting.

**AIR BASINS**. These are the areas in which weak dispersion conditions result from the effects of obstructions on the normal wind flow pattern. These obstructions are elevated topographic features, such as mountain ranges or canyon walls.

**ALLOTMENT**. An area of land where one or more operators graze their livestock. It generally consists of public lands but may include parcels of private or state owned lands. The number of livestock and period of use are stipulated for each allotment. An allotment may consist of several pastures or be only one pasture.

**ALLOTMENT MANAGEMENT PLAN (AMP)**. A concisely written program of livestock grazing management, including supportive measures, if required, designed to attain specific multiple use management goals in a grazing allotment.

**ALLUVIAL SOIL**. A soil developing from recently deposited alluvium and exhibiting essentially no horizon development or modification of the recently deposited materials.

**ALLUVIUM**. Clay, silt, sand, gravel, or other rock materials transported by flowing water. Deposited in comparatively recent geologic time as sorted or semisorted sediment in riverbeds, estuaries, floodplains, lakes, and shores, and in fans at the base of mountain slopes.

**AMBIENT AIR QUALITY**. The state of the atmosphere at ground-level as defined by the range of measured and/or predicted ambient concentrations of all significant pollutants for all averaging periods of interest.

**ANIMAL UNIT MONTH (AUM)**. The amount of forage necessary for the subsistence of one cow or its equivalent for a period of one month.

**ANTHROPOGENIC**. Relating to man's activities. Anthropogenic pollutant sources include space heating, vehicular traffic, industrial activity and construction.

**ATMOSPHERIC DISPERSION MODEL**. A mathematical simulation of the atmospheric transport and dispersion of pollutants used to predict pollutant concentrations.

**BACKGROUND CONCENTRATION**. A pollutant level which could be expected in an area in the absence of any anthropogenic pollutant sources.

**BAGHOUSE**. A stationary source pollution control system designed to filter particulates at over 99 percent efficiency.

**BIOLOGICAL ASSESSMENT**. A procedural step in the interagency consultation process under Section 7 of the Endangered Species Act where the BLM submitted a written summary of potential project impacts to threatened or endangered species to the USFWS for their evaluation.

**BRECCIA**. A fragmental rock, the components of which are angular. Any rock formation essentially composed of uncemented, or loosely consolidated, small, angular shaped fragments.

**CALCINE**. To expel volatile matter by heating, with or without oxidation; roasting of ore.

**CANOPY COVER**. See plant cover (aerial).

**CARRYING CAPACITY**. The maximum number of animals possible without inducing damage to vegetation or related resources. Carrying capacity may vary from year to year on the same area due to fluctuating forage production.

**CHIMNEY DRAIN**. Verticle drainage structure constructed internally within spent shale and processing waste disposal piles.

**CLIMATE**. The statistical collective of an area's weather conditions during a relatively long interval of time (usually several decades).

**COLLUVIUM**. Loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity. Talus and cliff debris are included in such deposits.

**COMMERCIAL WOODLAND**. Is a pinyon-juniper stand that must: (1) have volumes of timber, preferably pinyon, adequate for economic harvest, (2) be located on slopes less than 25 to 30 percent, and (3) be in close proximity to existing roads.

**COMPOSITION**. The proportions of various plant species in relation to the total in a given area.

**CONTRAST**. The relative difference in luminance between an object and its background. Inherent contrast is contrast as perceived at the position of the observed object. Apparent contrast is contrast as perceived at the observer's position.

**CRITICAL WINTER RANGE**. That area where all individuals of the species of interest are located at the point in time when distribution is most restricted over an average five winters out of ten.

**DEFERRED ROTATION SYSTEM**. Discontinuance of grazing on various parts of a range in succeeding years, allowing each part to rest successively during the growing season to permit seed production, establishment of seedlings, or restoration of plant vigor.

**DIP**. The angle at which a bed, stratum, or vein is inclined from the horizontal plane. It may vary from a perpendicular to the earths surface to an angle perhaps only a few degrees below the horizon.

**DISTILLATE**. The liquid obtained by condensing a vapor.

**DISPERSION POTENTIAL**. The ability of the atmosphere to dilute or disperse air pollutants, as determined by normal ventilation values. A high dispersion potential results from high ventilation values, which can be caused by high transport wind speeds, high mixing heights, or high values of both.

**DIURNAL**. Pertains to meterological actions that are completed over a day and night cycle.

**EMISSION FACTOR**. An empirically derived mathematical relationship between pollutant emission rate and some characteristic of the source such as volume, area, mass, or process output.

**ENDANGERED SPECIES**. Any species which is in danger of extinction throughout all or a significant portion of its range.

**ENDEMIC SPECIES**. A species whose natural occurrence is confined to a certain region and whose distribution is relatively limited.

**EVAPORATION**. The physical process by which a liquid or solid is transformed to the gaseous state.

**EVAPOTRANSPIRATION**. The combined loss of water from a given area during a specific period of time, by evaporation from the soil or water surface and by transpiration from plants.

**FUGITIVE DUST**. A type of particulate emission made airborne by forces of wind, man's activity, or both, such as unpaved roads, construction sites, tilled land, or windstorms.

**GAME FISH**. Any fish species for which seasons and bag limits are prescribed; fish worthy of pursuit for sport or food.

**GRABEN**. A depressed segment of the earths crust bounded on at least two sides by faults and generally of considerable length as compared with its width.

**GRAZING CAPACITY**. As used in this document, the maximum amount of livestock use permitted on an allotment per year.

**GROUND COVER**. The area of ground surface occupied by the stem(s) of a range plant, as contrasted with the full spread of its herbage or foliage, generally measured at one inch above soil level.

**GROWING SEASON**. Generally, the period of the year during which the temperature of cultivated vegetation remains sufficiently high to allow plant growth.

# GLOSSARY

**HABITAT**. A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

**HALITE**. Impure common salt, NaCl (sodium-choride); cubic crystals. Occurs widely disseminated or in extensive beds and irregular masses, and interstratified with rocks of other types as a true sedimentary rock.

**HERBACEOUS**. Green plants with leaflike appearance or texture, not including shrubs, trees, mosses, or lichens.

**HERBAGE**. Usually used in the same sense as forage, except that it may include material not acceptable to grazing or browsing animals.

**HABITAT EFFECTIVENESS**. The actual capability of a habitat site to support a wildlife population. It is determined by calculating the total productive potential minus any natural or man-caused impacts or factors which make an area to be less than fully effective for wildlife use.

**HYDROCARBON**. A chemical compound comprised principally of carbon and hydrogen, but also containing varying amounts of other elements (i.e., sulfur, nitrogen, chlorine).

**INDIRECT IMPACTS**. Impacts caused by something which, itself, is a result of something else. In economics, indirect impacts are caused by growth in trade and service activities which, themselves, result from a primary source of growth such as mining.

**INTERFACE**. Contact boundary either between spent shale wastes and native rock or soil. Could be the boundary between differing layers of spent shale.

**IRRIGATED PASTURE LAND AND HAYLAND OF STATEWIDE IMPORTANCE**. These are lands which for one or more reasons, do not meet the requirements for prime farmland. However, lands in this category are important to the agricultural economy in Colorado.

**JOINT FREQUENCY DISTRIBUTION**. Set of meterological data describing the concurrent frequencies of occurrence of defined wind directions, wind speed classes, and atmospheric stabilities.

**LONG'S SYNDROME**. When you think you've got it but you don't.

**MASS WASTING**. The movement of rock debris downslope in large masses of material moving either quickly or slowly from one place to another.

**METER**. The basic metric unit of lengths; one meter is equivalent to 3.28 feet.

**MIXING HEIGHT**. The height above the ground to which turbulence causes the air to be well mixed.

**MODELING**. A mathematical or physical representation of an observable situation. In air pollution control, models afford the ability to predict pollutant distribution or dispersion from identified sources for specified weather conditions.

**MOLYBDENOSIS**. Molybdenum poisoning is the consumption of forage on soils of a molybdenum-copper inbalance of sufficient quantity to provide toxic results to ruminents. Prominent symptoms in cattle include emaciation, scours, anemia, stiffness, reproductive difficulty and occasionally death.

**NEPHELOMETER**. An instrument which measures the scattering coefficient of an air sample which can be interpreted as visual range.

**OPERATOR**. See permittee.

**OVERSTORY**. That portion of a plant community that is dominant as to height, the tallest plants on a given site.

**PASQUILL STABILITY CLASS E**. The stability category which corresponds to nightime meterological conditions with less than 3/8 cloud cover and surface winds between 2 and 5 meters per second.

**PASSERINE**. Is the order and classification of perching birds.

**PASTURE**. Is a subdivision of a grazing allotment on public lands. The number of pastures is variable between allotments.

**PERMITTEE**. Holder of a license or permit for grazing on an allotment.

**pH**. A measure of the acidity or alkalinity of a solution. Water is considered to be neutral at a pH of 7, acid if pH is less than 7, and basic if greater than 7.

**PHOTOCHEMICAL REACTION**. Chemical reaction in which the activation energy (driving force) is supplied by solar radiation.

**PLANT COVER**. The percent of an area covered by any part of living plant material (aerial plant cover), or that percent area occupied by the portion of living plants at the point of emergence from the ground (basal plant cover).

**POINT SOURCE**. A pollutant source whose origin of emissions can be approximated by a single point.

**POLLUTANT**. Any gaseous, chemical, or organic waste that contaminates air, soil, or water.

**POLLUTION**. The contamination of soil, water, or the atmosphere by the discharge of noxious substances.

**PREVAILING WIND**. The most frequent compass direction from which the wind blows.

**PRIME FARMLAND**. In general, prime farmlands in Colorado have an adequate and dependable water supply from irrigation (a dependable water supply is one in which enough water is available for irrigation in 8 out of 10 years, for crops commonly grown); a favorable temperature and growing season; acceptable acidity or alkalinity; acceptable salt and sodium content; and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for long periods of time and they either do not flood frequently or are protected from flooding.

**RADIATIONAL COOLING**. The cooling of the earth's surface and adjacent air, accomplished (mainly at night) whenever the earth's surface suffers a net loss of heat.

**RADIOMETER**. An instrument which measures the apparent radiance of a target and its apparent background radiance which can be interpreted as visual range.

**RANGE SITE**. A type of rangeland with inherently different soil characteristics that produce a significantly different kind or amount of potential vegetation.

**RAPTOR**. Birds of prey with sharp talons and strongly curved beaks; e.g., hawks, owls, eagles, falcons.

**RETORT**. A vessel used for solid to liquid distillation of oil shale by applying indirect or direct heat. Can occur in above ground facilities or below ground in place.

**REGIONAL VISIBILITY**. Visibility predicted to occur in the region around a source or group of sources resulting from particulate, sulfate, and nitrate concentrations in the vicinity of these sources.

**RILL**. A small intermittent water course with steep sides, less than 6 inches deep.

**RIPARIAN**. Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow rooted in the watertable of streams, ponds, and springs.

**SECONDARY IMPACTS**. See INDIRECT IMPACTS.

**SENSITIVE SPECIES**. A species included on the sensitive species list developed by the Colorado State Office pursuant to section CL of Instruction Memorandum No. 80-722 and approved by the State Director. These lists will generally include any species in the State which meet any of the following criteria:

a. Candidate species are any species not yet officially listed but which are undergoing a status review or are proposed for listing according to *Federal Register* notices published by the Secretary of the Interior or the Secretary of Commerce.

b. Rare or infrequent species whose populations are consistently small and widely dispersed, or whose ranges are restricted to a few localities, such that any appreciable reduction in numbers, habitat, or habitat condition might lead toward extinction.

c. Other species whose numbers are declining so rapidly that official listing may become necessary as a conservation measure. Declines may be the result of one or more of several factors including: overuse for commercial, scientific, or educational purposes; disease, predation, or grazing; the inadequacy of existing regulatory mechanisms; and/or other natural or human factors adversely affecting the species continued existence.

**SHEET EROSION**. The removal of a fairly uniform layer of soil from the land surface by runoff water.

**SLOPE FAILURE**. Downward and outward movement of material in an unconsolidated mass; (slumped); material that has slid down from a higher position on a slope.

**SOIL HORIZON**. A layer of soil, approximately parallel to the soil surface, with comparatively uniform characteristics.

**SPECIES**. An organism which is, and remains, distinct because it does not normally interbreed with other organisms.

**STRATIGRAPHY**. Descriptive geology of an area or district which pertains to the discrimination, character, thickness, sequence, age, and correlation of the rocks.

**STRATOSPHERIC**. Pertaining to the stratosphere, the atmospheric layer above the tropopause; a very stable layer characterized by low moisture content and absence of clouds.

**SYNOPTIC**. Weather patterns associated with high and low pressure systems in the lower troposphere.

**THREATENED SPECIES**. Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

**THORACIC PARTICULATES**. Also known as inhalable particulates. Particles less than 15 microns in diameter which are not filtered in the nostrils and can be lodged in the windpipe and lungs causing health damage.

**TOPOGRAPHY**. The exact physical features and configuration of a place or region; the detailed and accurate description of a plan or region.

**TOPSOIL**. Fertile soil or soil material, usually rich in organic matter, used to top-dress disturbed areas. Topsoil is better suited to supporting plants than other material.

**TOTAL SUSPENDED PARTICULATES (TSP)**. The portion of the total particulate matter in the atmosphere consisting of particles so small that the particles settle out very slowly.

**TRANSPORT WIND**. The average horizontal wind speed component perpendicular to a vertical cross section of the atmosphere. In this report, the vertical limits are defined by the ground and the mixing height.

**UNDERSTORY**. That portion of a plant community that grows underneath taller plants growing on the same site.

**UNIQUE FARMLAND**. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yield of a specific crop, when treated and managed according to acceptable farming methods. In Colorado only fruit orchards and vegetable producing areas of high production are considered unique.

**VEGETATION TYPE**. A plant community with immediately distinguishable characteristics, based upon and named after the apparent dominant plant species.

**VISIBILITY**. A measurement of the maximum distance to which large objects may be viewed. Fixed reference objects such as mountains, hills, towers, or buildings are normally used to estimate visibility.

**VISUAL RANGE**. A standardized form of visibility that approximates actual observed visibility. It is the maximum distance at which an average human eye with a threshold perceivable brightness contrast of .02 at a wavelength of 5,500 Angstroms can detect an ideal black object against the horizon sky in daylight.

**WET ADIABATIC LAPSE RATE**. The standard rate of decreasing temperature of moist air with increasing altitude (at constant energy).

**WIND ROSE**. A graphical display of wind speed and wind direction frequencies at a meterological station. The bar graphs extend into the direction from which the wind blows. These directions are the sixteen compass point directions (i.e., north, north-northeast, ..., northwest, and north-northwest).

**WINTER RANGE**. That area where all individuals of the species of interest are located in over an average five winters out of ten during the period 15 December to 15 March.

## LIST OF ABBREVIATIONS

AQRV -- Air Quality Related Values
BACT -- Best Available Control Technology
bbl/day -- barrels per day
C-a -- Rio Blanco Oil Shale Tract
C-b -- Cathedral Bluffs Shale Oil Tract
cm -- centimeter
CO -- Carbon Monoxide
°C -- degrees Centigrade
°F -- degrees Fahrenheit
EIS -- Environmental Impact Statement
gm/sec -- grams per second
km -- kilometer
m -- meter
mb -- millibar
m/s -- meters per second
NEPA -- National Environmental Policy Act
NM -- National Monument
NMHC -- Non-Methane Hydrocarbons
$NO_x$ -- Oxides of Nitrogen
$NO_2$ -- Nitrogen Dioxide
$O_3$ -- Ozone
PSD -- Prevention of Significant Deterioration
$SO_2$ -- Sulfur Dioxide
TAPAS -- Topographic Air Pollution Analysis System
TSP -- Total Suspended Particulates
$T_{15}$ -- Thoracic particulates (less than 15 microns)

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# REFERENCES


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# PART 2

# COMMENTS ON THE DRAFT EIS
# AND
# RESPONSES TO COMMENTS

# PART 2

# COMMENTS ON THE DRAFT EIS AND RESPONSES TO COMMENTS

Part 2 of the Final EIS includes a copy of all the written comments on the Draft EIS, oral testimony presented at the public hearings held in Denver (August 24, 1982), Meeker (August 25, 1982) and Grand Junction (August 26, 1982), Colorado, and responses to those comments. Each individual comment that appears in Section A, Comments on the Draft EIS, has been bracketed, and a number assigned to it that corresponds to a response listed in Section B, Responses to Comments, immediately following the comments. If a particular comment is simply an observation or is in agreement with the text, no response has been made.

## A. Comments on the Draft EIS

The letters appear in the order they were received by the Oil Shale Projects Team. Following the letters, are the public hearing transcripts in the order the hearings were held. To reduce the total volume of reprinted materials in the text, extensive attachments to some comment letters that do not raise specific issues have not been included. Also, the public hearing transcripts that are reprinted only include that portion where comments were made on the Draft EIS. Those portions of the letters and the transcripts that have not been reprinted are available for public review in the BLM White River Resource Area Office in Meeker, Colorado, and in the BLM Colorado State Office in Denver, Colorado.

For ease of reference, the letters have been listed below according to source. The letter number refers to the number in the upper right hand corner of each comment letter.

| Commenter | Letter Number |
|---|---|
| **Federal Agencies** | |
| Department of Interior | |
| U.S. Fish and Wildlife Service (Biological Assessment Review) | 1 |
| U.S. Fish and Wildlife Service | 8 and 55 |
| National Park Service | 18 |
| Bureau of Reclamation | 35 |
| Minerals Management Service | 45 |
| U.S. Geological Survey | 51 |
| Bureau of Mines | 54 |
| Department of Energy | 40 |
| Western Area Power Administration | 7 |
| Department of Transportation - Federal Highway Administration | 9 |
| Environmental Protection Agency | 53 |
| **Colorado State Agencies** | |
| Department of Natural Resources | 46 |
| Colorado Natural Areas Program | 46a |
| Mined Land Reclamation Division | 46b |
| Division of Wildlife | 46c |
| Colorado Geological Survey | 46i |
| Department of Agriculture | 46d |
| Department of Education | 46e |
| Department of Health | 46f |
| Colorado Historical Society | 46h |
| Department of Highways | 46j |
| Division of Water Resources | 46k |
| **Local Government Agencies** | |
| Pitkin County | 19 |
| Rio Blanco County | 27 |
| Garfield County | 28 |
| Associated Governments of Northwest Colorado | 31 |
| **Environmental and Public Interest Organizations** | |
| Colorado Mountain Club | 17 |
| Environmental Defense Fund | 39 |
| Friends of the Earth | 38 |
| Garfield County Citizens Association | 43 |
| League of Women Voters of Colorado | 33 |
| National Audubon Society | 13 |
| National Wildlife Federation | 37 |
| **Public Institutions** | |
| Pioneers Hospital | 36 |
| University of Colorado | 41 |
| Washington State University | 10 |
| **Professional Consultants** | |
| Robert E. Chancellor | 2 |
| J. Phyllis Fox Consulting Services | 42 |
| Geothermal Surveys, Inc. | 30 |
| Stearns-Roger Engineering Corporation | 4 |
| **Industry and Industrial Associations** | |
| American Petroleum Institute and American Mining Congress | 52 |
| Cathedral Bluffs Shale Oil Company | 29 |
| Chevron Shale Oil Company | 21 |
| Cities Service Company | 22 |
| Colorado-Ute Electric Association, Inc. | 20 |
| Industrial Resources, Inc. | 5 and 6 |
| Mobil Mining and Coal Division | 48 |
| Multi Mineral Corporation | 15 |
| Rio Blanco Oil Shale Company | 50 |
| Rocky Mountain Oil and Gas Association | 44 |
| Shell Oil Company | 23 |
| Sohio Shale Oil Company | 47 |
| Union Energy Mining Division | 49 |



S-396381 0001(00)(15-JAN-83-10:28:44) F0171/ 5/22/82

## COMMENTS ON THE DEIS

| Commenter | Letter Number |
|---|---|
| **Individuals** | |
| Ginny Aragon | 16 |
| Elisa Dancing Bird, et al | 24 |
| Carol Green | 11 |
| Gregory J. Gustafson | 12 |
| Jeanne T. Hemphill | 14 |
| Barton Hibbard | 25 |
| David Schein | 34 |
| Lillian Valenzuela | 32 |
| Thelma Zabel | 26 |
| **Public Hearings** | |
| Denver - August 24, 1982 | D |
| Meeker - August 25, 1982 | M |
| Grand Junction - August 26, 1982 | G |

**United States Department of the Interior**

FISH AND WILDLIFE SERVICE
ENDANGERED SPECIES OFFICE
1406 Federal Building
125 South State Street
Salt Lake City, UT 84138


16 July 1982

IN REPLY REFER TO:

MEMORANDUM

TO: Area Manager, Meeker Resource Area, U. S. Bureau of Land Management, Meeker, Colorado

FROM: Acting Project Leader, Endangered Species Office, U. S. Fish and Wildlife Service, Salt Lake City, Utah

SUBJECT: Review of Biological Assessment - Two Proposed Prototype Oil Shale Base Tracts (C-11 and C-18)

In response to your 21 April 1982 biological assessment and request for informal Section 7 consultation. The Fish and Wildlife Service (FWS) is providing you this review of your assessment.

BIOLOGICAL ASSESSMENT REVIEW

NON-AQUATIC SPECIES

The proposed oil shale energy projects on prototype oil shale base tracts C-11 and C-18 is not expected to affect the black-footed ferret (Mustela nigripes), bald eagle (Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus), and the whooping crane (Grus americana).

AQUATIC SPECIES

Due to uncertainties as to the size of the proposed oil shale operation and the specific technology to be used the Bureau of Land Management (BLM) is at present unable to accurately forecast the size of water depletion from the White River, if any. Section 7 Interagency consultation will have to reinitiated when BLM receives detailed development plans from prospective developers. The FWS therefore defers its biological assessment review on the Colorado squawfish (Ptychocheilus lucius), and the humpback chub (Gila cypha) until the future lessee submits its preliminary development plan to the BLM and its detailed development plan to the Minerals Management Service as discussed in the biological assessment.

PROJECT DESCRIPTION

Lease, for multi-mineral recovery of oil shale, nahcolite and dawsonite, two tracts of 5118 acres each in the Piceance Basin, Rio Blanco County, Colorado. Included in the lease are tracts C-11 and C-18 approximately 20 miles southwest of Meeker, Colorado. Four leasing alternatives are: 1) lease both tracts; 2) lease tract C-11 only; 3) lease tract C-18 only; or 4) lease neither tract. Mining technologies most likely will include one of the following three: 1) Direct Mining and Surface Retorting; 2) Mine Assisted In-Situ; or 3) True In-Situ. Water use will be primarily dependent on the process selected for



development the oil shale deposit. It is expected that most of the water needed for mining and processing will be generated on tract from groundwater. As much as 4,620 acre-feet/year may be required from the White River.

BASIS OF REVIEW

NON-AQUATIC SPECIES

The FWS concurs with the biological assessment prepared by the BLM, dated 21 April 1982 for the black-footed ferret, bald eagle, peregrine falcon, and whooping crane. The project is not expected to have an effect on these four species.

AQUATIC SPECIES

Colorado squawfish and humpback chub were once abundant throughout the Colorado River System from the Gulf of California to southwestern Wyoming. Presently, the squawfish is limited to the upper mainstem and its major tributaries of the Colorado River System. The humpback chub is found only in limited areas within the river system in Colorado, Utah, and Arizona. The primary cause of decline for these fish species is human alteration and degradation of the river environment. Major impoundments and water diversions have depleted water supplies and altered the temperatures, turbidity, salinity, and flows of the stream, thus reducing habitat for endemic fishes.

There are three major interacting factors that explain in major part the present status of the endemic species of the Colorado River Basin. These are: 1) reservoirs; 2) diversions of water from the Basin for various uses; and 3) environmental changes in the river brought about by 1) and 2).

The most obvious and clearly identifiable factor contributing to the decline of native species is the large dams and reservoirs that converted hundreds of miles of river habitat into great impoundments. Prior to the listing of the endangered fishes, the preservation of these fishes was not considered in the planning and operation of these projects. It has been determined that Colorado squawfish, humpback chub, and bonytail chub do not reproduce successfully in large reservoirs. The alterations resulting from the large dams changed a river of great extremes of flow, temperature, and turbidity into a series of reservoirs discharging cold, clear water at a relatively constant rate of flow and temperature. Since the native fishes' life stage requirements are based on the natural river conditions, they could not adapt to the changed conditions, and populations rapidly declined. The adults present in the river when a dam is constructed may continue to live in a reservoir and may thrive and grow, but the populations consist of fewer, larger, and older fish each successive year until they all die of old age or other causes.

Water depletions both directly by diversion and indirect by consumption and evaporation from the Colorado River Basin have drastically altered flow patterns, water quality parameters, river channel characteristics, and have contributed to the elimination and alternation of the quiet backwater nursery areas for many of the endemic Colorado River fish species. For the Colorado squawfish much essential habitat is no longer present. There is general agreement among Federal and State biologists studying endangered fishes of the Upper Colorado that the natural flow regime of high spring and early summer flows followed by a gradual period of decreasing summer flows are beneficial to Colorado squawfish and humpback chub reproduction.

A less important cause of decline may be the increased number of exotic fishes, but this increase in exotics also is a function of habitat changes. Although correlations exist between declining native fish populations and increasing populations of exotic fish, cuase and effect are not fully understood. The evidence of harmful effects of non-native species on the endangered Colorado River fishes is largely circumstantial. However, there is no doubt that fewer exotic fishes would be present if the river more closely resembled its natural state.

To increase knowledge of the Colorado River endemic fishes' (primarily the listed endangered species) habitat requirements, a Colorado River Fishery Project (CRFP) team was established in April 1979. This team is staffed with FWS personnel and has funding from the FWS, Bureau of Reclamation (BR), and the BLM. Other participants are the Utah Division of Wildlife Resources and the Colorado Division of Wildlife. Major objectives of the team's study were to learn additional life history requirements of the listed fishes. Under our funding agreement with BR and BLM, most of the field work was in the Green and Colorado Rivers where impacts from BR and BLM projects are the greatest. Information obtained during the stufy via field, laboratory and hatchery work has made it possible to provide recommendations to maintain and develop more favorable habitat for the listed fishes. As a result of the CRFP study the FWS has determined that the Colorado squawfish and humpback chub are experiencing declines in their present habitat and without active reclamation action will become extinct. Any further degradation of their environment such as water depletion will likely accelerate the extinction of these species if not properly offset by active conservation measures.

As new information becomes available concerning this project the FWS encourages the BLM to re-enter Section 7 consultation under the Endangered Species Act in order to resolve any conflicts involving water needs for oil shale development and maintaining endangered Colorado River fishes. We appreciate your interest in conserving endangered species.

John L. England





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July 21, 1982

Oil Shale Projects Leader
White River Resource Area
P. O. Box 928
Meeker, Colorado 81641

RE: Comments on the Draft Supplemental Environmental Impact
Statement for the Prototype Oil Shale Leasing Program

Dear Sir:

The preparers of subject document should be highly commended for the consistently excellent quality of its content. More important, they deserve the deep appreciation of all parties interested in oil shale development. The work brings together and judiciously summarizes a large body of diverse data regarding oil shale. The even handed clarity of the document is exemplary of the work that will be necessary if the federal government is to ever evolve a proper long term policy to guide its oil shale endeavors. This book will be required reading for anyone involved in any aspect of oil shale.

The unavoidable conclusion to be reached from a study of the document is that it would not be in the public interest to lease any more public lands for oil shale development at this time. The basic reason for this conclusion is that although leasing of the proposed tracts is in conformance with an existing Management Framework Plan of 1973 vintage, the 1973 Management Framework Plan is admittedly outdated and should absolutely not be used in reaching further decisions on oil shale leasing.

As stated, the Bureau of Land Management is in the process of developing a long term regional oil shale leasing program and Environmental Impact Statement for Federal Lands. Any future leasing must key to the final completion of these documents.

The 1973 Management Framework Plan is unquestionably flawed in a variety of ways. The primary goal of the prototype program was "to provide a new source of energy to the nation by stimulating the development of commercial oil shale technology by private industry." After almost ten years this is simply not being accomplished by the prototype program.

If we really want the government to help private industry achieve near future commercial scale multi-mineral extraction -- rather than playing politics, wouldn't we logically accelerate work at the existing Horse Draw facility? Maybe that's the kind of recommendation that will come out of the highly important updated Management Framework Plan study. Maybe that's what worries the sponsors of this latest hurry-up leasing plan.

Oil Shale Projects Leader
July 21, 1982
Page Two

In fact, the subject document inadvertently supplies many of the reasons for the failure of the original prototype leasing program. The proposed leases are about six miles equidistant from Tracts C-a and C-b. Mining on the proposed leases would be much more complicated than it is on C-b. There are a bunch of laid off miners who will confirm that C-b has yet to solve its mining problems.

In philosophic summation, this admirable Environmental Impact Statement tells the perceptive Decision Maker - "If you want to create more unnecessary conflicts with oil and gas development, gas pipelines and ranching, by starting another speculative project in an area where two other similar government sponsored projects are already in deep trouble - using a faulty, outdated document to justify your decision, then go right ahead. That would be right in line with the old oil shale tradition. It won't screw things up much more than they're already screwed up. But don't ever say we didn't lay all the facts in front of you."

Sincerely yours,

Robert E. Chancellor

ROBERT E. CHANCELLOR

cc: Senator William L. Armstrong
Senator Gary W. Hart
Congresswoman Patricia Schroeder
Congressman Timothy E. Wirth
Congressman Ray Kogovsek
Congressman Ken Kramer
Congressman Hank Brown
Governor Richard Lamm
Mr. James R. Rollo, Office of the Director, Dept. of Interior
Mr. Charles F. Metzer, U. S. Dept. of Energy
Mr. Bob Burford, Director - BLM
Captain G. R. Gilmore, CEC, USN
Mr. Hillary A. Oden, USGS
Mr. John Trippe, Conservation Manager, Central Region
Mr. Frank A. Salwerowicz, Deputy Conservation Manager, Central Region
Mr. Edgar W. Guynn, District Supervisor
Mr. John L. Price, District Supervisor
Mr. Peter A. Rutledge, Area Oil Shale Supervisor
Mr. B. Curtis Smith, Area Manager, BLM
Oil Shale Environmental Advisory Panel, Attn: Mr. Henry O. Ash
Mr. Roger Williams, Regional Administrator, EPA
Mr. Steve Schmitz, Colorado State Energy Impact Coordinator
Mr. Kevin Markey
Mr. David A. Coppedge, Sun Gas Company
Mr. Joe H. Crosby, CSG Exploration Company
Mr. Jon Rex Jones, Jones Company
Editor, The Daily Sentinel, Grand Junction
Mr. Dick Martin, Carbondale, Co.
Mr. William Brennan, Rifle, Co.





Stearns-Roger
ENGINEERING CORPORATION

July 26, 1982

Oil Shale Projects Team Leader
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, CO 81641

Re: DEIS for the Prototype Oil Shale Leasing Program

On page 4 of the Summary regarding air quality impacts of the No Action Alternative, your conclusions are completely misleading.

The estimated concentrations for $SO_2$, TSP, and $NO_x$ at Rifle, as a result of the private oil shale development predicted for the area west of Rifle, are entirely unrealistic. Under current federal and Colorado law, such dangerously-high concentration levels are illegal and would not be allowed. It is totally inconceivable that both Congress and the Colorado Legislature would relax the existing air quality standards to such health-threatening levels, except possibly during emergency situations such as complete cessation of foreign oil imports or war time. (1) (34)

The proper and correct analysis of air quality impacts under the No Action Alternative is to assume that no illegal facilities would be permitted. Thus, the highest concentrations that would be allowed would not exceed the PSD increments for $SO_2$ or TSP or the NAAQS for $NO_x$. Any other impact assessment to the contrary is improper and incorrect.

If I were a resident of Rifle and saw these predicted concentration levels, I would be scared to death.

Sincerely,

STEARNS-ROGER ENGINEERING CORPORATION

Don S. Packnett

Don S. Packnett, CCM
Staff Meteorologist
Environmental Sciences Division

DSP/liz/1545h

4500 CHERRY CREEK DRIVE • P O BOX 5888 • DENVER COLORADO 80217 • PHONE (303) 758-1122 • TWX 910-931-0453 TELEX 045-540

5

INDUSTRIAL RESOURCES, INC.
1101 WEST 8TH AVE. SUITE 301
DENVER, COLORADO 80215

AREA CODE 303/232-2942

July 26, 1982

Mr. John Singlaub
Oil Shale Projects Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, Colorado 81641

Dear John: RE: Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program

There is an apparent problem in correlating the shale oil, nahcolite, and dawsonite resource data. In Chapter II, pages 35 and 38 tabulate the resource losses for Tracts C-11 and C-18 under various extraction scenarios. When this data is recalculated in the minerals industry acceptable term, i.e., recoverable resources, and compared to the information in Chapter III, pages 63 and 64, there are some significant discrepancies. For example, one would be on Tract C-18. By calculation the recoverable shale oil resource for direct mining and surface retorting amounts to 1.638 billion bbls. in Chapter II, while in Chapter III it is stated to be 2.297 billion bbls. I am certain these differences were a result of the short time limitations imposed on compiling this complex document along with the continuous submittal of revised information during the compilation.

Unless there is some unapparent reasoning, I believe the overall percentage recovery factors should be quite similar for both tracts. Probably a somewhat lower recovery should be applied to Tract C-11 because of the adverse local mining conditions that would result from the effects of Dudley Bluffs Graben. Again when the percentage recoveries for shale oil are calculated from pages 63 and 64 for both Tracts under the direct mining scenario, the recoveries are 28.2% for Tract C-11 and 22.4% for Tract C-18. This is a significant difference.

(2)

I am assuming the various discrepancies will be corrected in the final draft.

Very truly yours,

INDUSTRIAL RESOURCES, INC.

Edward C. Rosar
President

ECR:cr

cc: Mr. Arthur S. Bowes, Jr.

6

INDUSTRIAL RESOURCES, INC.
1101 WEST 8TH AVE. SUITE 301
DENVER, COLORADO 80215

AREA CODE 303/232-2942

July 29, 1982

Mr. John Singlaub
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, Colorado 81641

Dear John: RE: Draft Supplemental EIS for Prototype Oil Shale Leasing Program

On page 98, column 2, para. 4, a statement is made... "Approximately 4840 acres of Tract C-18 is currently being leased to Wolf Ridge Corporation for the mining of sodium". Please check this acreage again and advise me if this is correct.

In my letter dated July 26, 1982, I discussed the problem of correlating the resource estimates and recoveries for Tracts C-11 and C-18. In this letter I failed to mention that Table IV-5, page 125 should be corrected accordingly.

(2)

Sincerely yours,

INDUSTRIAL RESOURCES, INC.

Edward C. Rosar
President

ECR:cr

cc: Mr. Arthur S. Bowes, Jr.

7

Department Of Energy

JUL 30 1982

In Reply
Refer to: L2130

Mr. John Singlaub
Team Leader
Bureau of Land Management
White River Resource Area
317 East Market Street
P.O. Box 928
Meeker, CO 81641

Dear Mr. Singlaub:

We acknowledge the receipt of the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program and appreciate the opportunity to review and respond to its content. At this time, we do not see any problems with, nor have any objections to, the draft but would appreciate your continued cooperation relative to coordinating Western Area Power Administration's future transmission activity with the oil shale leasing program.

Please advise if you have any questions.

Sincerely,

Lloyd D. Nelson
Lloyd D. Nelson
Assistant Area Manager
for Engineering

RECEIVED

8

United States Department of the Interior
FISH AND WILDLIFE SERVICE
ENDANGERED SPECIES OFFICE
1406 Federal Building
125 S. State St.
Salt Lake City, Utah 84138

IN REPLY REFER TO

9 August 1982

MEMORANDUM

TO: Area Manager, Meeker Resource Area,
U. S. Bureau of Land Management, Meeker, Colorado

FROM: Project Leader, Endangered Species Office,
U. S. Fish and Wildlife Service, Salt Lake City, Utah

SUBJECT: Prototype Oil Shale Leasing Program (C-11 and C-18) Supplemental DEIS

We have received the subject DEIS and have reviewed the relevant portions pertaining to endangered species. We refer you to our review of your biological assessment dated 16 July 1982 sent to your office. We would expect that consultation under the Endangered Species Act would be necessary if the proposed oil shale project alters the flow or water quality of the White River. Ecological Services of the Fish and Wildlife Service may correspond separately concerning other wildlife values. (3)

Please note our new address above.

RECEIVED
Bureau of Land Management

Fred L. Bolwahnn
Fred L. Bolwahnn

9

**U.S. DEPARTMENT OF TRANSPORTATION**
FEDERAL HIGHWAY ADMINISTRATION
REGION EIGHT
555 ZANG STREET, BOX 25246
DENVER, COLORADO 80225

August 19, 1982

HEP-08

Mr. John Singlaub, Team Leader
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, Colorado 81641

Dear Mr. Singlaub:

Thank you for the opportunity to review the Draft Supplemental EIS for the Prototype Oil Shale Leasing Program. We find the DSEIS provides a very thorough analysis of potential impacts for the alternatives studied.

Although the DSEIS indicates close interagency coordination, which is essential for successful development of the program; there is no indication of formal coordination with the Colorado Department of Highways or the Department of Interior's Oil Shale Environmental Advisory Panel. Since there will be quite heavy impacts on the highway systems in the project area, we would suggest that you coordinate this document and continue a close working relationship with the Colorado Highway Department. As well, the Oil Shale Environmental Advisory Panel was established to assist the Secretary of the Interior on projects such as this. Again, we would suggest close coordination with this group.

Sincerely,

Fred Hempel

Fred Hempel
Director, Environmental Programs

10

**WASHINGTON STATE UNIVERSITY**
PULLMAN, WASHINGTON 99164-4006

DEPARTMENT OF SOCIOLOGY/DEPARTMENT OF RURAL SOCIOLOGY
Room 23, Wilson Hall

August 19, 1982

Dr. John Singlaub, Team Leader
Bureau of Land Management
White River Resources Area
P.O. Box 928
Meeker, Colorado 81641

Subject: Socio-cultural impacts of the Prototype Oil Shale Leasing Program: Technical review of the Draft Supplemental Environmental Impact Statement.

As a public service, I periodically provide review comments on the aspects of environmental impact statements that are within my area of competence. The comments below reflect my own professional judgment; they do not represent the Department of Rural Sociology, or Washington State University.

This review concerns the Draft Supplemental Environmental Impact Statement (dEIS) for the Prototype Oil Shale Leasing Program. The comments focus primarily on this document's assessment of likely social impacts. Before the criticisms are offered, however, it is appropriate to note two particularly praiseworthy aspects of this dEIS.

While this dEIS is not perfect, it is notable for its clarity. Clear writing is a rare commodity in EISs, and the team that put this dEIS together deserve high praise for their efforts to write in English instead of jargon. Further room for improvement still is possible, of course; the editors appear to have paid more attention to the early, introductory sections of the dEIS than to the later, more detailed technical discussions, for example, and the use of "impacted" (as a verb and an adjective), apparently crept into this dEIS despite careful editing otherwise. Even so, this document is so clearly above average in its intelligibility that special recognition is warranted. Its clarity is in the top 10 percent of all the EISs I have read. In terms of compliance with the letter and the spirit of the Council on Environmental Quality's regulations for implementing the procedural provisions of the National Environmental Policy Act (particularly 40 CFR 1500), this is without a doubt the best dEIS I have read in the last year and a half. The CEQ regulations note that the purpose of an environmental impact statement is to provide a decision-maker with information--doing so accurately, clearly, and dispassionately--rather than to spill a sea of defensive jargon across so many pages that the relevant information is effectively hidden from public view. I hope other writers of EISs will follow your lead.

The second praiseworthy point has to do with the document's clarity of thinking in the area of analysis that is the focus of this review. The document

focuses upon "social impacts" as social ones--rather than assuming or asserting that they have somehow been "covered" in the process of dealing with economic impacts or esthetic concerns. In fact, as social scientists have been noting for more than half a decade, the social impacts of major developments often differ systematically from the economic impacts as well as from the esthetic impacts. By dealing with the social impacts directly, this dEIS has taken a significant step toward complying with the CEQ regulations that EISs contain "accurate scientific analysis" (40 CFR 1500) and that EISs discuss the social as well as the economic and physical environmental effects (40 CFR 1508). Moreover, this particular analysis appears to have been written by professionals who have a reasonably accurate comprehension of the social character of the region.

While praise is deserved on both of these points, however, the dEIS still has important weaknesses. One of them is understandable--at least at present--but absolutely unacceptable within the Regulations' call for "accurate scientific information." The "baseline" conditions used in this dEIS are totally without professional credibility. They call for massive growth in the study region; in fact, it is now widely known that stability, or even decline, is the more likely condition. It is not enough for the document to say obliquely that the decision-maker "should consider" the fact that the baseline projections are now known to be inaccurate (and dramatically so). The NEPA regulations say clearly (40 CFR 1500) that EISs are required to present scientifically accurate evidence to the decision-maker--who, after all, cannot be expected to have the expertise to be able to comprehend the full social science significance of the error. (This problem is particularly severe in the case of the social impacts; its relevance to other types of impacts is for others to judge.)

It is now widely known that the Colony project has been shut down, and virtually all other oil shale development activity in the area is at a standstill. Even area coal mines are now laying off workers--with an important recent example being the shut-down of the Rineau No. 2 mine near Meeker. In fact, the most reasonable assessment at present is that area communities (including Rifle, and particularly including Meeker) will be in a period of stability or perhaps even slight decline, rather than in a period of extremely rapid growth, as the "baseline" condition. Since all impacts are compared against the baseline condition, the present document would effectively provide the decisionmaker with systematically erroneous information--and with information that is known to be erroneous. The proposed leasing could indeed lead to boom conditions both in Rifle and in Meeker, but it would do so against a baseline of stability, rather than of pre-existing growth, and a long series of expected impacts will therefore be significantly different from what is projected in the current draft of the EIS. It is unfortunate that many of these recent developments took place after work on the dEIS began, but they have taken place, and the Regulations make it clear that they must be taken into account. (4)

The remaining comments focus on more specific details of the social impact analysis. Most importantly, with regard to Table IV-18, there appears to be a growing consensus among social scientists that a simple listing of "+/-/0" is not an appropriate one, at least as a way of conveying information on social impacts. The compactness of this table is commendable, and it appears that your social scientists have put a good deal of thought into it, but the general rule would seem to apply here as well, for three reasons. First of





all, the NEPA regulations clearly say that the EIS is meant to convey information on significant impacts; a simple +/- listing does not convey any information on significance to the decisionmaker. Second, a +/- listing does not give the decisionmaker relevant information on what is actually likely to happen (a prose description, whatever its drawbacks, can at least give the decisionmaker enough information that he/she is able to come up with his/her own assessment of how significant that outcome is likely to be). Third, and most importantly, a simple +/- listing does not provide the needed information on the reasoning that has been employed in developing the positive and/or negative information. (While many of the entries in Table IV-18 appear quite reasonable, some of the judgments do not appear to be consistent with existing evidence--for example, the best available evidence strongly indicates that young persons in booming communities experience substantial psychological stress, and that report their opportunities for interaction to be significantly negative. (See the evidence summarized in Freudenburg, 1982). The table currently lists psychological well-being for the youth as "+ -" and lists the interaction opportunities as "+"; your social scientist(s) presumably had a rationale for these decisions, but if so, the reasoning employed (and the reasons for not drawing instead from the best available quantitative evidence) should be clearly stated. (5)

A number of other, more minor suggestions can be offered. One is that, as suggested earlier, the editing job in the technical social science sections of the document does not appear to have been as careful as in the earlier pages. There seem to be a number of cases where words and/or punctuation have been omitted, changing the meaning or impairing the clarity of the discussion. (6)

Another is that some of the statements need to be qualified--e.g., on p. 159: "with full operation, social structural and social psychological changes will also slow to an acceptable, comfortable pace because of this population leveling" (emphasis added). This conclusion is plausible, but it represents conjecture rather than research findings, and thus it needs to be more carefully qualified. (2)

The dEIS is impressively accurate in noting that differences between long-time residents and construction workers are not nearly as stark as they are often expected to be, and it is quite refreshing to see EIS writers who have enough familiarity with the relevant sociological data to be aware of this point. Even so, there appear to be a number of social changes taking place in boomtowns that are not related to differences between oldtimers and newcomers, but which are rather related to basic social structural changes, and to other increases in stress levels that are taking place. These latter impacts need to be more fully discussed, particularly because the best available evidence suggests that they are caused by the rate of growth per se--a point that has obvious relevance to mitigating (as well as assessing) the impacts. (5)

While these are points that need to be improved, however, it is important to note again the significance (and praiseworthiness) of having an explicit discussion of social impacts included in the dEIS. This discussion provides an important foundation for the necessary improvements. (The far more common error is for EISs to omit such discussions entirely--a procedure which, as noted earlier, is in open conflict with relevant NEPA regulations.) The present EIS has made significant strides toward complying fully with the

10

spirit and the letter of the relevant regulations, and it is to be hoped that future EISs will follow its example in that respect.

REFERENCE
William R. Freudenburg, 1982. "The Impacts of Rapid Growth on the Social and Personal Well-Being of Local Community Residents." Pp. 137-170 in Bruce A. Weber and Robert E. Howell, eds., Coping with Rapid Growth in Rural Communities. Westview Press, Boulder, CO.

With best wishes,

William R. Freudenburg, Ph.D.
Director, Washington State Project on
Social Impacts of Community Change

WRF:gb

11

Carol Green,
4207 S. Hudson Pkwy.,
Englewood, Co. 80110

August 25, 1982

Oil Team Projects Leader,
BLM, White River Resource Area,
P.O. Box 928
Meeker, Colorado

I am writing about the leasing of oil shale deposits in the western slope area. I believe that the environment is important, but it must be taken in perspective. As long as reasonable safeguards are in place, it is important to make job opportunities available for the people of the western slope. They were badly hurt by Exxon's pullout. Let's keep their interests high in the decision making process.

Sincerely,

Carol Green

Aug. 25, 1982

Dear BLM Oil Projects Team Leader:

I feel very strongly that your agency should not give out the two new Shale Leases north of Rifle. These massive projects and their shale retort process will disrupt the water supply; specifically the two Key aquafers in the area. In addition, the ensuing sulfur dioxide, and nitrogen oxides emitted from the shale processing and it's accompanying growth will seriously pollute one of our great western treasures - clean, clear air. The prevailing winds will carry this fouled air to the high country, where the snowpack is so essential for Front Range water supplies! I strongly call on your Bureau to deny these permits to an industry beset with economic, and





environmental problems! Thank you.

Cordially yours,

Mr. Gregory J. Gustafson
2439 14th Ave. Ct.
Greeley, Co 80631

13

Audubon Ecology Camps/Workshops

# National Audubon Society

August 25, 1982 4150 DARLEY, SUITE 5, BOULDER, COLORADO 80308 (303) 499-5409

Mr. John Singlaub
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, CO 81641

Dear John:

The National Audubon Society would like to submit the following as a supplement to comments made at public hearings August 24, 1982, in Denver, on the Draft Supplemental EIS for the Prototype Oil Shade Leasing Program.

Our first concern is that the EIS fails to address potential acid precipitation impacts. In the eastern United States, these impacts have included the acidification of lakes, elimination of fish populations, decreases in salamander reproduction, declines in fish-eating bird species, and declines in other aquatic species populations. Acid precipitation also increases the mobilization of heavy metal ions in affected ecosystems, with toxic effects elsewhere. Given these impacts, and the importance of recreational fishing in the Flattops and Mt. Zirkel Wilderness Areas east of the Piceance Basin, we feel the potential for acid precipitation should receive thorough discussion. (7)

Our second concern is that the range of alternatives considered in the EIS is too narrow. At a minimum, the alternatives should include development of other sources of energy - such as the natural gas deposits present - alternative leasing sites, and alternative control technologies available. It has become quite apparent from the events of the last six months that oil shale will not be developed as a replacement for imported oil while substantial oil supplies last - especially not when prices fall and there is a glut on the international market, as now. Rather, interested firms will develop oil shale, if at all, when conventional oil supplies have become scarce and prices are high. Oil shale actually holds less promise of eliminating the U.S. dependence on imported oil than solar, wind, hydropower, increased natural gas use, or coal, for which proven technologies are available. Therefore, we feel that development of alternative energy sources in the Piceance Basin needs attention. (8)

Thirdly, the EIS bestows little attention on air qualiity impacts for the Class I areas near the Piceance - Flattops, Maroon Bells, and Mt. Zirkel Wilderness Areas - other than to list 24-hour predicted pollutant concentrations. The effects on visual resources in these and primitive Class II areas are not covered at all. We stress that such lands, and the scenic vistas they offer, are a priceless resource. The EIS should clearly state what kinds of visual impacts additional oil shale development could have on these areas. (9)

AMERICANS COMMITTED TO CONSERVATION

13

(page 2)

The EIS does, however, suggest an answer to the whole question of whether or not more protype leases should be offered at all. Judging by the data herein, that answer is no. Impacts from development of either Tract C-11 or C-18, or both, will contribute additional environmental and social damage to a region already reeling from development by private interests on private lands. We also note that development of the first two prototype leases remains incomplete, and the data that were to proceed from operations there are likewise incomplete. Given this situation, we cannot believe that further leasing of federal tracts is either wise or necessary at this time.

I would like to congratulate the Bureau on a generally very readable and well-organized EIS, and on the openness and cooperation shown by the EIS team. We appreciate this opportunity to comment.

Sincerely,

Pauline Plaza

Pauline D. Plaza
Regional Representative

PDP:glt

cc: Marc Bosch, President, Colorado Audubon Council
Kevin Markey, FOE
Anne Vickery, CMC
Hester McNulty, LWV

**14**

P.O. Box 1674
Grand Junction, CO 81502
August 26, 1982

Oil Shale Projects Team
BLM White River Resource Area
P.O. Box 928
Meeker, CO 81641

Ladies/Gentlemen:

As a newcomer to Northwest Colorado, but not a newcomer to Colorado, I initially hesitated to comment on anything as formidable as the Bureau of Land Management's Prototype Oil Shale Leasing Environmental Impact Statement. Just the name was overwhelming.

However, this is all the more reason that I, a low income, concerned Colorado taxpayer and resident ought to speak out tonight. The future of oil shale in the Piceance Basin of Colorado will, in fact, affect me. It already has and will continue to do so. However, I would like to see oil shale's impact on my life carefully controlled. I live in Colorado by choice (not accident) because of Colorado's wide open spaces, clean air and water, beautiful desert and mountain country, small towns, etc.

I have been in Colorado long enough to see ups and downs and changes in quality of life. In my opionion, at this time more oil shale leasing will not improve most of our lives. Quite the opposite. In my case, the areas I like for recreation stand to be eroded in size and quality; the wildlife I enjoy will be pressured; and the boom cycle will bring housing and food costs which I cannot afford.

More to the point, however, is the fact that current oil shale processes are intensely energy comsumptive, resulting in a questionable gain of energy. Is it even possible that we take seriously such an industry in this day and age of energy awareness and conservation? This is not to mention the present economic infeasibility of oil shale, the problem of incomplete minerals recovery, and reclamation difficulties, etc. **(10)**

Until better technology develops and economics become more favorable to the average person, I urge no further leasing of BLM lands for oil shale.

Thank you for this opportunity to comment.

Yours,

Jeanne T. Hemphill

Jeanne T. Hemphill

**15**

MULTI MINERAL CORPORATION 2996 TELLER COURT • GRAND JUNCTION, COLORADO 81501 • (303) 245-7428

August 31, 1982

Oil Shale Projects Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, CO 81641

Re: Draft Supplemental EIS for the Prototype Oil Shale Leasing Program

Dear Sir:

Multi Mineral Corporation has reviewed the above referenced document and offers the following comments:

P. 9 - Summary 8th Full paragraph

The statement is made that the lower aquifer has a much higher salinity than the upper. Although this is true in some parts of the basin, in the area of the proposed leases there is actually not a great difference in salinity between the upper and lower aquifers. There are, however, significant quality differences between the aquifers, mainly in trace elements such as fluoride, arsenic, barium, boron, iron, lithium and strontium. USGS data taken from area wells TH75-6A and 6B in the upper aquifer and TH75-6B, -7B and -11B in the lower aquifer indicate that total dissolved solids (TDS) concentrations in the upper aquifer range from 612 to 1,020 mg/l and from 650 to 9,610 mg/l in the lower. Another well, Shell 23X-2, shows a range of 800-899 mg/l for the upper aquifer in the area. **(2)**

The high salinity indicated by the sample which was 9,610 mg/l from the lower aquifer is a false reading resulting from dissolution of nahcolite at the top of the Saline zone. This statement is supported by the fact that the maximum TDS concentration for the lower aquifer during a 7-day pump test on the proposed C-18 tract was 1,040 mg/l.

These data were submitted by MMC in the Expression of Leasing Interest.

p. 27 - Chapter 2, Sodium

Since the preparation of this draft EIS MMC has assigned its interest in Sodium Lease C-0118326 to Wolf Ridge Corporation, a wholly owned subsidiary of Industrial Resources Inc. Several years of resource characterization coupled with experience gained through 2½ years of mining in the Saline zone at the Bureau of Mines Horse Draw facility have convinced MMC that a sodium-only development cannot be carried out economically when so much of the sodium resource is excluded from development by lease stipulations designed to protect the oil shale. We believe that production of sodium from the lease can be economical on its own but only if the entire resource is available. Even if sodium-only development could be initiated on the lease within the constraints of the stipulations, MMC believes that the sodium-only mine would not be able to compete with sodium products produced from a combined oil shale/sodium development. In light of these facts, obviously development of the sodium lease will not be initiated in 1982 as stated in this section. (4)

P. 34 and 35 - Summary of Impacts, Geology

In the estimates of resource permanently lost as a result of development of C-11 under the three different types of technologies, both direct mining and mine assisted in situ are stated as definite losses by the use of "would." I believe "could" more properly states the degree of certainty on which this prediction is based. The statement on true in situ reflects the proper uncertainty by the use of "possible permanent loss." MMC believes that the resource not recovered by any of the three technologies could be recovered in the future either by an open pit or some other technology not yet developed. (2)

P. 35 - Summary of Impacts, Soils

This section states that the impacts on soils from true in situ would be less than from both other development technologies. On page 37, Surface Reclamation, as well as other places, the statement is made that true in situ has the most surface disturbance and greatest potential for soil loss. (11)



Also in this section the statement is made that leasing C-11 "would" be more damaging to the soil resource than leasing C-18. MMC believes again that the proper word is "could" since the impacts are totally dependent upon what is actually done on the lease, not on how many acres of a particular type of land exists. (6)

p. 36 - Summary of Impacts, Wildlife

The statement is made that deer road-kills would be 15-86% greater for C-11 than C-18. Although it is true that C-11 contains major migration routes for mule deer any product movement from C-18 development will have to cross these same migration routes. It is hard to believe the kills could be 86% greater for C-11 when C-18 traffic will be using basically the same roads in the same area. (12)

p. 38 - Summary of Impacts, Socioeconomics

The increased housing requirements in Meeker and Rifle for the C-11 alternative are based on a nahcolite mine. being developed on the existing Sodium lease. Since MMC no longer has any association with the Sodium lease this potential development is doubtful. The current lessee has owned the lease since its issue in 1971 and very little activity occurred prior to MMC attempting to develop it. As stated earlier, MMC has severe doubts that a sodium-only mine can be developed under the existing constraints of the lease stipulations.

p. 38 - Summary of Impacts, Transportation

Again the doubtful nature of sodium development on the Sodium lease should be identified. (4)

p. 39 - Combined Alternative, Geology

The estimate of permanent loss of resource resulting from direct mining is stated as being definite when again it should be "could" as it is in the estimates for mine assisted in situ and true in situ in this section.

p. 58 - Affected Environment, Climate

The sentence at the end of the first partial paragraph on this page is missing something. (6)

15



p. 72 - Hydrology, Groundwater quantity

The next to the last paragraph in this section states that groundwater movement is upward from the lower aquifer through the Mahogany zone into the upper aquifer. As was shown by the data submitted in MMC's Expression of Leasing Interest, in the area of the proposed leases (specifically on C-18) the potentiometric surface for the upper aquifer is higher than the lower making it unlikely that groundwater could move upward against the gradient. (13)

p. 102 - Spent Shale and Shale Processing Waste Disposal, Cementation of Spent Shale

The last paragraph of this section states that the sodium is removed prior to retorting. Sodium is also recovered following retorting from the Na value of the dawsonite as well as any sodium which was not recovered from the nahcolite prior to retorting. (2)

p. 110 - Environmental Consequences, Air Quality

In the paragraph discussing the estimation of visibility impairment, the statement is made that mine assisted in situ (MAIS) at 50K and 100K BPD levels would cause impairment while the direct mining with surface retorting (DM/SR) would not. The reason for this is evident in reviewing the emission rates given on Table IV-1 which indicate MAIS has two times the emission rate for TSP, 3.7 times the rate for $SO_2$ and 3.4 times the rate for $NO_x$ compared to direct mining with surface retorting. MMC believes there is too much disparity in these emission rates. The fact that TSP emissions for MAIS is more than twice that for DM/SR hardly seems reasonable when you consider the fact that a MAIS may only process 20-40% of the rock on the surface while to generate at the same level of production for DM/SR, 100% of the rock is taken to the surface for processing. Processing underground should minimize TSP emissions since the mine functions as an impinger removing particles as the ventilation air passes through the mine. The $SO_2$ emission rate 3.7 times higher for MAIS than for DM/SR also makes no sense. In fact the rate used for $SO_2$ emission exceeds state standards. The high emission rate for $NO_x$ would appear to be due to higher temperature retorting, a condition that is not true for a hot gas to solids retorting in the absence of oxygen as proposed by MMC. (14)

p. 123 - Development Alternatives, Extraction of Mineral in the Saline Zone

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The compressive strength given for nahcolite (15,000 psi) is only true for the microcrystalline type of nahcolite which is found in a bed known as the Love bed as well as in lesser deposits in other parts of the Saline zone. Most of the nahcolite is of a coarser-crystal type and would have a much lower compressive strength than Love bed nahcolite.

p. 133 - Groundwater Quality, Aquifer Mixing Through Mine Development

The statement is made again that in the lease area, the lower aquifer has a much higher salinity level than the upper. This is not a true statement (refer to the first comment in this letter). (2)

p. 186 - Adverse Environmental Effects Which Cannot Be Avoided, Geology

This section states that up to 75% of the mineral "would" be lost. As stated previously MMC believes "could" more correctly expresses the degree of uncertainty in the statement.

p. 187 - Short Term vs Long Term, Geology

Again this section uses "would" instead of "could."

p. 189 - Irreversible or Irretrievable Comittment of Resources, Geology

This section again states the loss of resource as definite by the use of "would." The first statement that the resources "would be left unrecovered" is true but MMC believes the use of "would result in even more resources being irretrievably lost" is more correct when stated as "could" since that fact depends on what occurs in the future, not on the fact that the entire resource is not recovered at this time. (6)

p. 190 - Uncommitted Mitigation, Hydrology

It should be pointed out that the recommendation to operate retorts in excess of 800°C will preclude the recovery of aluminum from dawsonite. All available data indicates that dawsonite which has been subjected to high temperatures decomposes to a form of aluminum that is insoluble under all but the most severe conditions. MMC feels that recommendations such as this which involve processing conditions obviously need to consider more than just an attempt to minimize solubility in spent shale and would be more properly a part of DDP approval than this EIS. (2)

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Page 6

MMC would like to commend BLM for the excellent document which has been produced under the time and budgetary constraints which were part of the effort. Overall, MMC believes this Draft Supplemental EIS to be a concise and thorough evaluation of the potential impacts which might result from expanding the Prototype Oil Shale Leasing Program.

MMC appreciates the opportunity to make these comments and hopes they will be useful to BLM in preparation of the final EIS.

Sincerely,

Jim Meredith

Jim Meredith
Manager, Support Operations

JAM:ls

16

Sept 1, 1982

Oil Shale Projects Team Leader
BLM
White River Resource Area
Box 928
Meeker, Colo 81641

Greetings;

I am writing this letter in regards to the proposed oil and gas leasing of Tracts C11 and C18. I feel that these sites, located so closely to the existing Ca + Cb tracts poses several serious problems that need to be heard before permits are issued.

My overriding reaction is that there seems to be no purpose in leasing new tracts in the Piceance Basin since the two preceeding tracts have not met objectives. The burden then

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posed by these two additional tracts would put undue strain on air quality, water drainage and wildlife habitats. (This EIS seems to be in conflict with the Department of Wildlife's -Division- goals to increase range). (15)

Certainly, at this stage of the economy, there seems to be little use in gearing up the surrounding communities for separate socio-economic impacts (again!) when the track record for oil shale leasing is so poor.

The issues of traffic, noise, waste disposal have never been adequately examined other than mentioning them as potential areas of impact.

The economy also has not indicated oil shale as economically feasible. (16)

Even with multi-use permits, the costs of mitigating impact could make this one of the



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on again - off again leasing that is so devastating to local communities.

My own concerns revolve around drilling into the lower aquifers. I have never read any information on drilling operations that adequately deals with drilling safety near drainage areas, protecting the aquifers or leaching harmful wastes into water supplies. (17)

Many of these companies have decent records on reclamation however, the unanswered questions on waste disposal plus soil erosion outweigh intentions on reclamation. (18)

Oil shale technology is still very primitive. The inefficiency of the mining process seems like such a waste balanced against the detrimental effects. It is hard to believe that leasing

16

continues when such a high percentage of shale is left unrecovered. Certainly more valuable land doesn't need to be turned over to this type of experimentation until the technologies have improved to mitigate the technical impacts and increase the efficiency of shale recovery.

Now is NOT the time.

Sincerely,

Ginny Aragon.


Box 882
Glenwood Spgs Co
81602


17

# The Colorado Mountain Club


GROUPS ASPEN • BOULDER • DENVER • DENVER JUNIOR • DENVER WILDERNESS KIDS • EL PUEBLO
ENOS MILLS • FORT COLLINS • LONGS PEAK • PIKES PEAK • SAN JUAN • WESTERN SLOPE

TELEPHONE
922 8315

2530 WEST ALAMEDA
DENVER COLORADO 80219


John Singlaub, Team Leader
Bureau of Land Management
White River Resource Area
PO Box 928
Meeker, CO 81641

September 2 1982

Dear Mr. Singlaub,

Following are comments from the Colorado Mountain Club on the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program. These comments supplement the comments presented at the BLM public hearing of August 24, 1982.

1) The CMC, in its February 11, 1982 scoping comments, asked that preference be given to potential lessees demonstrating zero emissions technology and less labor intensive technology. This request was not discussed in the Draft. With this request in mind, the Section in Chapter I, discussing the prototype program, should be expanded to include the following points:

a) The prototype leases and the existing private operations have been in various stages of development long enough to illuminate serious impacts. If the prototype program is to be expanded, technologies should be considered which deal more successfully with these impacts. The ones we are primarily concerned with are:

1) We have experienced diverse and unquantifiable socialeconomic impacts due to an influx of a hugh work force. It is noteworthy that Colony, shortly before closing down, doubled the projected number of workers needed to complete construction. This indicates that even a sophisticated company such as Exxon does not have a good handle on manpower needs.

2) The "boom-bust" cycle seems inevitable, inspite of the good intentions of government and business. We are now aware of the ever widening repercussions this cycle has on local, state and national levels, on individuals, businesses and governments.

3) We are aware that air pollution from all sources associated with oil shale development will impact Wilderness Areas National Forests, local towns, river valleys and the Piceance Basin to a degree which violates several federal and state standards This pollution is unacceptable to local people, to federal landmanagers and is contrary to the Wilderness concept.

(19)

b) Technology needs to be developed which is less manpower intensive thus cutting down on socioeconomic impacts and the impacts of the "boom - bust" cycle

c) Technology needs to be developed which eliminates or completely recycles emissions so that a zero emission state is achieved. A zero water discharge technology is presently employed by mining companies including two private oil shale operations. There is currently a call from politicians for recycling of hazardous wastes. It is high time that this concept was applied to air emissions which have a devastating effect on human health, crops, water and animal life.

Please discuss these concepts in the Final EIS

2) The Final EIS needs to clearly distinguish between a) baseline monitoring b) monitoring during construction and operation and c) modeling.

a & b) Monitoring: The real question is: what the actual air quality will be over Class I Wilderness Areas, in the National Forests, in the Class II public lands, in the towns along the Colorado and White River Valleys and in the Piceance Basin; how will this air quality affect visibility, plant and animal life? The only way to effectively answer this question is to establish monitors in all the potentially affected areas: in the Class I areas, in the National Forests, up and down the river valleys and in the Piceance Basin. The Final EIS and the Stipulations should contain provisions requiring leesees to do complete monitoring, including inside the Class I areas, before construction and during construction and operations. (20)

c) Modeling: The CMC requested in the scoping comments that emissions from all associated sources be modeled. The DEIS does not include this information, nor does the document explain that the projected levels of pollutants will inevitably be higher because associated sources will be adding emissions to the air.

1) The concept of the baseline in the DEIS is not clear. It is not clear that it is a modeled baseline. It is not clear that it does not include all the associated, secondary and tertiary sources whether they fall under PSD or not. It is not clear that it excludes some major point sources. It is not clear that the baseline is the same as the "no action" alternative. It is easy to confuse this baseline with the baseline monitoring which should be going on now. The modeled, "no action" alternative should include all existing all permitted, all secondary and associated sources. (2)

2) At worst the Final EIS should state that some secondary sources and primary sources have not been included, therefore the air quality impacts will be considerably greater than the level projected from the sources which are included in the modeling.

3) Impacts from oil shale development, including all associated sources are projected to affect visibility and acid deposition in the Colorado Class I



Wilderness Areas. With this in mind, the CMC requested in the scoping comments that an assessment of these impacts be made:

a) How will sulfates, nitrates, other fine particles and $NO_x$ from all combined emissions contribute to visibility degradation in the Flattops Maroon Bells-Snowmass, Mt. Zirkel and Holy Cross Wilderness Areas and the mainstem valley of the Colorado River?

b) What will be the concentration of fine particles in the Flattops, Maroon Bells-Snowmass, Mt. Zirkel and Mt. of the Holy Cross Wilderness Areas and in the Class II areas in the White River and Routt National Forests? (9)

c) In the Flattops Wilderness Area how will the cumulative emissions impact sensitive lichen species, brook trout, aspen and the Ph of Ned Wilson Lake, Surprise Lake and Parvine Lake?

d) In the Maroon Bells-Snowmass, Mt. Zirkel, Mt. of the Holy Cross Wilderness Areas how will the cumulative emissions impact sensitive lichen species, brook trout, aspen and the Ph of selected lakes?

It is important that a discussion on these specific issues be included in the Final EIS.

4) In the scoping comments the CMC asked that the EIS consider recreational impacts of increased populations from oil shale development; how that impact will be managed and mitigated; where the Forest Service will get the additional funds necessary for intensive management. Many people will take advantage of the recreational opportunities in the Wilderness Areas. We have learned from other Wilderness Areas that overuse and mismanaged use can create resource damage which may be irreversible. The Draft EIS limited the discussion of recreation mainly to hunting. We request that the Final EIS address the above concern. (21)

5) Oil Shale Lease Environmental Stipulations:

a) Section 1(B) Changes in Conditions: The condition allowing changes in stipulations upon mutual consent only between the Mining Supervisor, the BLM District Manager and the Lessee is much too broad in scope. This condition must include provisions for public review of change in any stipulation that in any way affects public land, air water, wildlife and funds. The way the condition now reads would allow behind the scenes political pressure to be exerted on either government official. Where public resources and funds are involved, this situation must always be prevented. (22)

b) Section 8(A) Air Quality: The CMC strongly objects to the provision that the lesses shall avoid or where avoidance is <u>impracticable</u>, <u>minimize</u> air pollution (underlining ours). Impracticable and minimize are very broad terms and give the lessee a way out in lieu of developing new and perhaps more expensive technologies to eliminate or recycle emissions. The possibility of serious, long-term and in some cases irreversible impacts from air pollution from oil shale development are so apparent that the choice must always be to eliminate emissions and other sources of air pollution. The lessees should be required to develop technology which avoids air pollution. (23)

6) Included with this packet are the five slides shown at the public hearing:

a) A view of one of the many lakes in the Flattops Wilderness, the second largest Wilderness area in Colorado, 235,000 acres, known for its fishing.

b) From Flattops looking north east to the Zirkel Wilderness eighty to ninety miles away.

c) Looking east from the same point as (b) to the Gore Range (Gore Eagle's Nest Wilderness) sixty to seventy miles away.

d) Looking south east from the same point as (b) to the Holy Cross Wilderness Area and the Maroon Bells-Snowmass Wilderness (center) seventy miles away.

e d) A view of the Zirkel Wilderness, an area of 139,000 acres, known for its fishing.

f e) A view from Davis Peak in the Zirkel Wilderness looking toward the Sawtooth Range.

g f) One of the many lakes in the Zirkel Wilderness.

7) The State of Colorado has two National Monuments, Colorado National Monument and Dinosaur National Monument which could be affected by the leasing proposal. The Draft EIS does not discuss the air quality standards in effect for these areas, nor the impacts from development. These areas are unique to the state and are visited each year by many people from around the nation. The Final EIS should do a thorough analysis of air quality impacts from potential development on these areas. (2)

Sincerely,

Anne Vickery

Anne Vickery
Conservation Director
Colorado Mountain Club



United States Department of the Interior

NATIONAL PARK SERVICE
ROCKY MOUNTAIN REGIONAL OFFICE
655 Parfet Street
P.O. Box 25287
Denver, Colorado 80225

IN REPLY REFER TO:
N3615(492)

SEP 2 1982

Memorandum

To: Bureau of Land Management, White River Resource Area

From: Regional Director, Rocky Mountain Region

Subject: DEIS for the Prototype Oil Shale Leasing Program

The National Park Service has received and reviewed the Draft Supplemental Environmental Impact Statement (DEIS) for the Prototype Oil Shale Leasing Program. We are providing the following comments for your consideration in finalizing the document.

General

A fundamental concern that we have with this DEIS is that it presents potential impacts from additional prototype leasing relative to impacts from an artificially high baseline. This artificial baseline assumes production at a level which is unlikely to occur, and the impacts from the artificial baseline scenario are so immense that impacts from the proposed additional prototype leases appear insignificant in comparison. This is of particular concern because several of the sources identified in the baseline (i.e., the Colony and La Sal projects) may not even begin operation, let alone achieve the maximum production levels assumed herein, during the years analyzed for this DEIS. (4)

Since the DEIS does not present combined impacts resulting from the baseline sources plus the proposed leases, the reader has no means of knowing the full magnitude of potential impacts. (24)

Air Quality

In addition to problems with the baseline scenario, as stated above, an understanding of the air quality impacts from the proposed additional leasing is further complicated because not all of the sources which may reasonably contribute to this air basin are analyzed cumulatively. Specifically, the Uinta Basin Synfuels DEIS (BLM 1982) demonstrates that synthetic fuel sources in Utah will likely impact class I areas in Colorado. Yet these Utah sources are not considered in the prototype DEIS. The lack of a cumulative analysis, Utah plus Colorado sources, results in total impacts to air quality resources being seriously understated. (14)

Year of the Visitor

18

The DEIS states that the National Ambient Air Quality Standards (NAAQS) for $NO_2$, $SO_2$ and TSP are violated under the baseline scenario, and that Prevention of Significant Deteoriation (PSD) increments for $SO_2$ and TSP are exceeded under the baseline scenario. It is, therefore, difficult to understand how any additional leasing can be contemplated, since existing laws and regulations would not allow new sources to be developed in this air basin under these circumstances. The DEIS appears, by stating prototype leasing impacts in relative terms, to subscribe to the theory that if it's already dirty, why worry about making it dirtier. (25)

While we believe, as the DEIS states, that it is possible that NAAQS are violated and PSD increments are exceeded under the baseline scenario, we note that these statements are contradictory to the conclusions of the Uinta Basin Synfuels EIS.

NPS Lands

The DEIS does not estimate or even mention the increased visitor use of NPS lands that is likely to accompany the projected population growth associated with issuing these leases. An analysis similar to that provided in the Uinta Basin Synfuels EIS (BLM 1982) would be useful for long-term NPS planning and management of park resources. We can provide visitor use statistics for NPS units, if that would be of assistance to you. (21)

Mitigation Measures

The mitigation measures presented in the DEIS do not provide any indication of the technical, economic and/or political feasibility of their implementation, nor any quantification of mitigation measure effectiveness. The inclusion of mitigation measures such as those identified on page 9 (surface water supply), page 10 (transportation), and page 121 (air quality) are too general to be meaningful. (26)

Conclusions

Based on the above, we do not believe that two of the goals of the 1973 Federal Prototype Oil Shale Leasing Program (which are reiterated in this DEIS) are well served by the leasing of additional prototype oil shale tracts at this time. These two goals are:

- to ensure the environmental integrity of the affected areas and at the same time develop a full range of environmental safeguards and restoration techniques that will be incorporated into the planning of a mature oil shale industry, should one develop; and

- to develop management expertise in the leasing and supervision of oil shale development in order to provide the basis for future administrative procedures. (16)

The 1973 EIS recognized the environmental uncertainties inherent in oil shale development. The EIS stated that additional federal leasing should not be permitted until adequate environmental data are obtained from operating prototype leases which would allow more accurate predictions of environmental impacts for future oil shale project analyses. Inasmuch



18

as none of the existing prototype leases have yet reached full production levels, and thus neither the desired environmental impact data are available, nor management expertise acquired, it seems premature to proceed with additional prototype leases at this time.

Specific comments on the air quality technical report are enclosed. We appreciate the opportunity to comment on this DEIS. If you have any questions please contact me at FTS 234-2500, or have your staff contact Mary Ann Grasser at FTS 234-6419.

Lorraine Mintzmyer

L. Lorraine Mintzmyer

Enclosure

cc: Scott Archer, Colorado State BLM Office

**pitkin county**

506 east main street
aspen, colorado 81611

September 3, 1982

George Francis, State Director
Bureau of Land Management
Colorado State Office Building
1037 20th Street
Denver, Colorado 80202

Dear Sir:

This is in response to the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program which was recently released by your office. These comments should be considered as the official Pitkin County response to this EIS, and we appreciate your including them in the record.

We have the following general comments on the need for further leasing:

This EIS notes four objectives of prototype leasing that motivated the original 1973 program. We would like to review those objectives and present our analysis of the liklihood that further leasing will make progress in meeting them.

1) "<u>To provide a new source of energy to the Nation by stimulating the development of commercial oil shale technology by private industry.</u>" Past experience, both with private and public land oil shale development indicates that resource availability is not a significant factor in limiting oil shale technology or production. In fact, the economics and politics of the oil industry have been decisive in dictating the boom-and-bust pattern of oil shale development. While prototype lease availability may alleviate some expense, the current status of operations on tracts C-a and C-b indicates that further leasing will not, in and of itself, provide a strong or guaranteed stimulus to further technological development. (16)

Furthermore, the technologies that the EIS identifies as being in need of further research (Multi-Mineral and True In-Situ development) are nowhere required of the lessee. If technological research is in fact a primary goal of the program it must be required in the body of the lease and not left to the discretion of the lessee. (27)



2) "<u>To ensure the environmental integrity of the affected areas and at the same time develop a full range of environmental safeguards and restoration techniques that will be incorporated into the planning of a mature oil shale industry, should one develop.</u>" This has obviously not been accomplished through the initial round of prototype leasing, but it is difficult to imagine how further leasing would insure progress towards this goal over and above that that could be expected from existing private and federal developments. The environmental difficulties associated with oil shale development are so numerous and potentially so long-term, they should be the subject of specific research projects, rather than adjuncts to large-scale production developments and the social and economic impacts that accompany them. As noted under #1) above, if environmental impact-mitigation research is in fact an objective, requirements for such research must be incorporated into the body of the lease. Instead, many necessary mitigation measures, such as minimum topsoil depths on spent shale piles, and surface water quantity monitoring, are included under "uncommitted mitigation" that may or may not be eventually required of the lessee. (28)

3) "<u>To permit an equitable return to all parties in the development of this public resource.</u>"

The weak expression of interest in further prototype leasing, the current depressed state of the oil shale industry and general economy, and the high costs of pursuing the preferred technologies (Multi-Mineral and True In-Situ), all suggest that even if prototype leases were offerred, economic conditions would dictate against development at a scale that would meet the objectives of the program. This could, in turn, result in a lowering of environmental standards, a lowering of royalty rates, or an easing of other lease requirements and restrictions in order to further stimulate development. If objective #3 is to be met, it would seem to make much more sense to postpone further leasing indefinitely until economic conditions are such that timely development would be likely. (16)

4) "<u>To develop management expertise in the leasing and supervision of oil shale development in order to provide the basis for further administrative procedures.</u>"

This goal could be reached through further leasing, but it is our judgement that the impacts which are identified as arising from further leasing are so great that this goal in itself cannot justify continuation of the leasing program.

Beyond these general and conceptual problems with expansion of the Prototype Leasing Program, we have several specific environmental concerns in response to the data presented in the EIS.

-<u>Acquifer mixing</u> - Chapter III, page 75 of the EIS notes the following: "The concentration of some trace elements within the loweracquifer are great enough to

be of environmental concern. Concentrations of barium, boron and lithium are consistently high in the northern part of the basin...Concentrations of barium exceed drinking water standards in 7 out of 11 wells sampled...The boron and lithium levels are high enough to be toxic to most plants." The threat to groundwater quality inherent in this statement is increased by the previous statements concerning the difficulty of avoiding or mitigating acquifer mixing and the relative lack of data on groundwater hydrology in the lease area. If the toxic elements of the lower acquifer were to degrade the relatively high-quality upper acquifer, a long-term, far-reaching environmental disaster could result, with effects far beyond the proposed development boundaries. (29)

- Wildlife - Several impacts from development of these leases will combine to severely impact wildlife, and particularly deer populations. Loss of critical winter range, disturbance of migratory corridors, increased hunting pressure, and increased potential for road kills and poaching will have a cumulative effect on deer populations. A weakness of the EIS's discussion of wildlife impacts is the absence of a table showing the total impact of these factors, plus several missing elements such as stress-caused losses, disturbance to fawning areas, and losses due to molybdenosis or unsuccessful revegetation. It appears that losses due to development of these sites could double losses resulting from all other currently permitted activities. Losses of this magnitude would be, in our view, unacceptable. Further, it must be emphasized that these are absolute losses and not merely displacement of population into other habitats. (30)

- Air Quality - We were struck by Figures IV 2 through IV 7. They seem to indicate that the majority of the private developments produce air quality impacts in the Roan Creek, Parachute Creek and Colorado River Valleys, while the Federal leases further north distribute their impacts further west to the Flat Tops Wilderness Area, contributing to the violation of Class I air standards in that area. This circumstance is inappropriate at best and contradictory at worst. (31)

- Vegetation - Optimistic estimates of total reclamation of disturbed sites and spent shale piles cannot be justified in light of the obstacles to successful revegetation which are noted in the EIS. These include:

1. Disposal or isolation of hazardous wastes
2. Achievement of spoils compaction sufficient to eliminate toxic leaching, erosion, salt loading, and slippage hazards.
3. Acquisition of sufficient topsoil to guarantee successful regrowth of native plants, including forage and shelter species. (18)
4. Determination of responsibility for ongoing monitoring of revegetation success.
5. South-facing slopes, heat-absorbing materials, and other microclimate problems.

These unresolved difficulties can only lead us to conclude that revegetation will continue to be inconsistent and problematic.





These are the most prominent, but by no means all of our concerns relative to these proposed leases. In general the overall social, economic, and environmental impacts which are identified cannot possibly be justified by the realtively small percentage of recoverable resource and the small overall contribution that would be made to our national energy needs. We urge the BLM to take no action on these leases at this time.

Yours truly,

Mark Fuller
Pitkin County Environmental Coordinator

MF:pb

Colorado-Ute Electric Association, Inc.
P. O. Box 1149
Montrose, Colorado 81402

Telephone (303) 249-4501 TWX 910-929-6924

September 3, 1982

Oil Shale Projects Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, Colorado 81641

Dear Sir:

Draft Supplemental
Environmental Impact Statement

Colorado-Ute would like to thank the BLM for the opportunity to comment on it's Draft Supplemental Environmental Impact Statement (DEIS) for the Prototype Oil Shale Leasing Program. Although we will not be directly involved with the proposed leasing program, emissions from our planned and existing facilities are addressed in the DEIS.

The computer modeled air quality impacts section presented in Chapter IV, Environmental Consequences, is of concern to Colorado-Ute. All computer modeling techniques have inherent inaccurancies stemming from assumptions and simplifications of "real world" conditions. The general and estimated nature of modeled results should be clearly understood and stated in the DEIS, so as not to present an inaccurate picture to anyone reading this report. Colorado-Ute has done extensive modeling and monitoring of its facilities, particularly the Southwest Project, and our results differ greatly from that presented in the DEIS. As Martin Jablonski of our staff mentioned in a conversation with your Mr. Scott Archer, we are willing to share the results of our air modeling effort with you and your staff. (32)

Another aspect of the air quality monitoring that presents a concern to Colorado-Ute is that your modeling, under the no action alternative (page 113), shows violations of the Class I increments in the Mt. Zirkel Wilderness Area, where presumably the source of the pollutants were from Colorado-Ute's Craig Station.





Although this is not explicitly stated, the modeled results on pages 117-119 show no interaction of the emission from the oil shale operations and Craig Station. If your modeling results were actually the case, Colorado-Ute would not have been issued permits by the State of Colorado and EPA to construct and operate Craig Station. In fact, the federal land manager that administers the Mt. Zirkel Wilderness Area concurred with EPA's analysis that no impacts would occur to that area prior to EPA issuing the Craig Station Unit 3 Prevention of Significant Permit. (1)

We urge the BLM to carefully consider the limitation of the computer modeling used in the DEIS, and re-evaluate the scenarios based on that modeling. As stated earlier, if we can be of assistance, please do not hesitate to contact me at 249-4501.

Very truly yours,

Jerry A. Walker

Jerry A. Walker
Manager, Environmental Services

JAW/MGJ;jal

Chevron

**Chevron Shale Oil Company**
Great West Plaza, Tower 2, 1625 Broadway, Suite 2150, Denver, CO 80202 • Phone (303) 623-8282

September 3, 1982

COMMENT ON THE DRAFT
SUPPLEMENTAL ENVIRONMENTAL
IMPACT STATEMENT (DSEIS)
FOR THE PROTOTYPE OIL SHALE
LEASING PROGRAM
3.18.2.4 BLM I

John Singlaub, Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, CO 81641

Dear Mr. Singlaub:

Chevron Shale Oil Company (CSOC) appreciates the opportunity to comment on the subject DSEIS. As a natural resources company, we are interested in orderly development of both public and private land while ensuring a sound environment for future generations.

We have reviewed the DSEIS and attended public meetings on the document. The Affected Environment (Chapter III) and Environmental Consequences (Chapter IV) sections on air quality, underground shale disposal and socioeconomics need up-date or revision. In synopsizing the input reports, important caveats have been omitted from text of the environmental consequences. The preliminary nature of the development cases without specific detail lead to conservatively overemphasized impacts.

If you have any questions on our comments in Attachments I - III, please contact me.

Very truly yours,

A W Verstuyft

A. W. Verstuyft

AWV:gp

Attachments

cc: D. E. Hurst
G. K. Fisher
M. J. Rock





ATTACHMENT I

Air Quality

The DSEIS is based on the work of D. L. Dietrich, D. G. Fox, M. C. Wood and W. E. Marlatt "Air Quality Impact Assessment for the DSEIS for the Prototype Oil Shale Leasing Program." Concurrent with their analysis, D. A. Latimer, W. R. Oliver and M. A. Yocke "Air Quality Impact Analysis of Synthetic Fuel Development in the Uinta Basin" analyzed similar data for the Uinta Basin Synfuels Development (Utah BLM). The TAPAS modeling used in the DSEIS is not validated as is RTM (see ES&T 16 #7, 386A (1982)). While the general modeling approach (Dietrich et.al. Section 2) is sound, the results shown in Table IV-2 (p. 113) are grossly overpredictive. (33) The predicted $NO_x$ impacts on Rifle, Colorado for the 2003 high level (p. 121) exceed by fivefold the worst value ever recorded in the South Coast Air Quality Management District (L.A. Basin) $SO_x$ and TSP values are grossly overestimated. (34)

Please refer to the Latimer report as referenced in the DSEIS that shows all of the proposed Piceance Basin Oil Shale Facilities in Colorado can be sited without exceedance of applicable air quality standards and PSD increments, except the Cathedral Bluffs facility which could violate the 24-hour average $SO_2$ PSD Class II increment and possibly the Class I increment in the Flat Tops Wilderness Area (see additional discussion of Flat Tops impacts below). These violations could be avoided if, as recently announced, the one high emission facility is not built or if better emission control technology than that assumed in this analysis can be employed. Maximum 24-hour average TSP concentrations at the site boundaries of a number of these Piceance Basin oil shale facilities may approach the Class II increment.

Secondary Emissions. The impacts of associated regional population growth and residential and commercial development (so-called secondary impacts) will be within all applicable standards, except that total suspended particulate (TSP) concentrations, which are currently in excess of standards throughout much of the region, will be exacerbated. Most of this impact is due to windblown dust and dust raised from unpaved and gravel roads. These large particles are not respirable and do not affect regional visibility. In addition, if this fugitive dust from secondary sources is included in the consumption of the PSD increments for TSP, and mitigation measures, such as paving roadways, are not employed, it is quite likely that PSD Class II increments for TSP will be exceeded in much of the region and that PSD Class I increments for TSP in Flat Tops and Mt. Zirkel may be exceeded.

Flat Tops Wilderness. The existing mandatory Class I area with maximum impacts from the proposed synfuel industry in the Uinta and Piceance basins is the Flat Tops Wilderness. If secondary TSP emissions in the Piceance Basin are not mitigated and are counted in the Class I increment consumption, without question there will be a violation of the Class I TSP increment. If not, then the Class I $SO_2$ increment could be constraining if all the Uinta and Piceance sources are considered and upper-bound estimates of maximum 3- and 24-hour average $SO_2$ concentrations in Flat Tops are utilized. Indeed, the substantial emissions from the proposed one facility dominate impacts in Flat Tops. If this project is shelved indefinitely, as recently announced, the Class I increment is not likely to be consumed in Flat Tops.

Attachment I
Page 2

Visibility Impairment. Even for the maximum synthetic fuel development scenario studied, regional visual range (visibility) will largely be unaffected by the industrial, commercial, and residential developments. Significant, local reductions in visual range could be observed in stagnant haze layers principally in the winter. These hazes would be caused by TSP emissions from industrial facilities, windblown dust, dust from roadways, and smoke from residential wood stoves and fireplaces. These hazes would be infrequent and localized and would not affect regional visibility and views in wilderness areas. Worst-case reductions in regional visual range are anticipated to occur in the summer when sulfate formation rates are highest. Worst visual range reduction is projected to be less than 10 percent and would be principally due to sulfate aerosol formed in the atmosphere from regional $SO_2$ emissions from synthetic fuel facilities and power plants. The predicted high TSP concentrations from secondary emissions are not expected to greatly reduce regional visibility. They would only cause local dust clouds.

Acid Deposition. Wet and dry deposition in the middle of the developed areas in the Uinta and Piceance basins may be at rates as great as those experienced currently in large areas of the eastern United States and in Europe. However, at distances beyond about 50 km from development ares, in wilderness areas, and throughout most of the region, deposition rates are expected to be typical of worldwide background conditions.





ATTACHMENT II

Underground Shale Disposal

P. 103, Column 2, last paragraph to p. 104, Column 1, paragraph 1-2. Our engineering judgment indicates less than 16-30%, depending on swell and compaction, of the spent shale could be backfilled in the mine. (39)

ATTACHMENT III

Social and Economic Effects

The draft EIS discusses the potential social and economic affects of the prototype leasing program. In some instances, negative statements are made without any supporting evidence. The draft fails to consider the planning for growth and the infrastructure expansion that has already occurred. It does not address the potential cooperation between the shale industry, the private sector, and various levels of government to manage growth. The draft seems to assume a worst case, "Rock Springs" analysis, ignoring both the planning for growth, and in some cases, the implementation of those plans that have already occurred. (35)
Specific comments, by page, are offered below:

1. Figures S-1, S-2, S-3, pages 5, 6 and 7:

   How were the population projections developed? What assumptions were used for employment and secondary population? The "no action" projections for Rifle appear high. (36)

2. Page 10.

   On what basis was the conclusion reached that "severe social structural breakdowns"... will occur? Is this with or without mitigation by oil shale developers? Is it with or without planning and growth management by local, state and federal agencies? Does it assume that all employees and induced population will live in existing communities, or were new towns and construction worker housing facilities considered? (37)

3. Page 27.

   Are the estimates of where employees will live supported by any monitoring data? For example, the Council of Governments estimates that 30% of employees will live in DeBeque, 14% in Rifle, and 16% in Parachute. This does not seem to track the actual growth in these communities. (38)

4. Pages 33-34.

   An influx of construction workers...creates...an alienation with existing townspeople. This is an all-encompassing statement without regard to housing and recreation programs for construction workers, or the existing composition of the communities. Are people in Rifle really alienated from construction workers? What about existing residents who are construction workers? Does the alienation extend to all construction workers, such as home builders, or just to shale oil workers? (40)

5. Page 34.

   The adverse impacts listed assume no mitigation by companies, no preplanning by government, and no financial assistance programs. (35)

6. Page 38.

   On what basis are the tax projections made? Does this include only property tax, or all tax revenues? Does it cover only direct taxes, or taxes derived from induced development also? (41)



7. Page 39.

   On what basis is the assessment of "severe" and "very severe" social impacts made? What is the distinction between the two? (37)

8. Page 40.

   What is the distinction between property taxes and revenues? Property taxes are revenues. Is this paragraph defining a budget deficit? If so, the assumptions concerning tax levies and assessed valuations should be clarified (42)

9. Page 86.

   "A rise in crime seems to be general." Is this "rise" arithmatic or geometric? Is it related to newcomers or oldtimers? Has there been a change in law enforcement personnel or reporting procedures? The cause and affect relationship is unclear here. (43)

10. Page 86-87.

   "....a rise in marital counseling..." Again, the cause and affect relationship seems unclear as does the validity of this "statistic." (44)

11. Page 87.

   "....hiring professional planners is strong evidence that local government planning processes are becoming more formal. Throughout the United States most communities are hiring professional staff. It is unlikely that <u>any</u> community in Colorado as large as Glenwood Springs does not have a professional planner and a professional city manager. The cause and affect relationship with oil shale development is not supportable. (45)

12. Page 88.

   Meeker hired a professional City Manager in 1978. (2)

13. Page 88.

   "....boom conditions which bring about social changes with their individual social psychological stresses...." What is the basis for this statement? (46)

14. Page 89.

   What is the basis for the conclusion about Rangely's "concerns about rapid growth"? (47)

15. Page 95.

   New construction is not covered under the 7% property tax limitation. (48)

16. Page 158.

In many cases, operations workers build up gradually during the construction phase of the project. Also, many construction workers have long term jobs lasting a number of years on one project. (49)

17. Page 159.

"....accompanying social disruption in the community..." This apparently assumes no mitigation, no construction worker housing facilities, no construction worker recreation programs, no pre-planning by the Community, and no cooperation between government and industry. (35)

18. Page 159.

Many construction workers are married, and commute home on weekends. During the week they have "single status" in construction worker housing facilities. One key to managing the impacts during the construction phase is pre-planning, and good cooperation between the company and the community. (2)

19. Page 166.

"....severe quality of life deterioration..." How was this conclusion reached? What defines "quality of life"? For some people it might be a steady job, for others might be increased shopping opportunities, and for others it might be maintenance of the status quo. (50)

20. Page 166.

"....The small town atmosphere and ethos with their associated psychological comforts for oldtimer citizens would be lost permanently..." What is the basis for this statement, particularly the conclusion it reaches? Some oldtimers are the strongest proponents of development. (51)(52)

21. Page 166.

Marital disturbance, divorces, alcoholism, etc. exist in most communities, including those undergoing no growth at all. As a community grows more support systems may exist to deal with these problems, and reporting of such problems may become more formalized. (53)

22. Page 167.

".... continued or worsened local inflation in housing costs..." In fact, increased local building activity, more money in local banks, and subdivisions that meet FHA or VA standards may increase the choices and reduce the costs of housing. (54)

23. Page 187.

"....lost would be the lifestyles and values associated with the small ranching towns..." What is the basis for this statement? What are the specific (2)







lifestyles and values, and how are they different in a community of 500, 1000, 2000, 3000, etc.?

24. Page 188.

Are there no short term positive benefits, such as increased planning capacity, increased local spending, a new labor and volunteer pool, etc? (55)

25. Page 189.

What is the basis for the conclusion on changing lifestyles and values? (56)

26. Page 191.

Mechanisms already exist for prepayment of property taxes and for severance tax credits. There is no evidence to conclusively support the need for increased severance taxes. From 1977 through 1981, 370 grants totalling $32,100,982 were made to local government from the severance tax fund. This is in addition to severance tax funds that go to the state school fund and the state general fund. A recent petition drive to increase severance taxes has failed and was, in fact, opposed by many local leaders in northwest Colorado. (57)

27. Page 191.

Construction worker housing facilities are not just trailer parks. They may include motel type accommodations, RV parks, recreation, laundry, and eating facilities. (58)

Terry H. Allen
VICE PRESIDENT
ALTERNATE FUELS

CITIES SERVICE COMPANY
Chemicals & Minerals Group
Box 300 Tulsa Oklahoma 74102

September 3, 1982

Oil Shale Projects Team Leaders
BLM, White River Resource Area
Box 928
Meeker, CO 81641

Gentlemen:

Cities Service Company wishes to offer comments on the draft Supplemental Environmental Impact Statement (SEIS) for the prototype oil shale leasing program. Cities is the owner of approximately 10,000 acres of land in southern Garfield County, a portion of which is underlain by oil shale of potentially commercial value.

Many of the conclusions offered in this supplemental EIS could adversely affect the future development of private oil shale lands, such as Cities' in Garfield County. Because of these possible impacts on Cities' property, the following comments are offered.

The whole subject of air quality as discussed in this EIS is a very sensitive one. Unfortunately, for some reason that is not clear, and in fact is not even eluded to, in the EIS, BLM chose to use non-standard, unverified, extremely over conservative, and by Cities Services' outside expert's opinion possibly technically flawed model in the EIS.

The use of this overly conservative model could presumptively lead to a decision against additional leasing. It also suggests that construction of a sizable percentage of the private development anticipated in the region might not be feasible.

Cities Service suggests that the BLM rethink and, in fact, redo this analysis using an EPA standard model. BLM should also caveat this model and any other one that it uses in the "Summary" portion of the SEIS since it is the main portion of the EIS that decision makers will use. (32) (59) (248)

Cities finds evidence in the SEIS itself, that the BLM understands some of these problems. For instance, on page





Page 2

109 it states in part "therefore the worst case assumptions in computer results expressed in this Environmental Statement, should not necessarily be construed as a basis for deciding not to lease". This, seems to imply that BLM has second thoughts about the use of the modeling techniques used. More fundamentally, Cities problems with the modeling techniques used can be summarized under three main headings:

First of all, the model technique used is a non-standard technique which has no interagency recognition. Hence, since the primary agency concerned with air quality modeling is the EPA, this TAPAS model has no formal standing at all with EPA.

Furthermore by federal law and by EPA regulations, there are only certain models approved by EPA for regulatory purposes. Hence, the TAPAS model has no regulatory authority at all and there should be no discussion at all in this EIS about compliance or non-compliance with PSD regulations. (59) (60)

Cities recommends that all reference to PSD compliance or non-compliance be removed from the SEIS if BLM persists in using this TAPAS model.

Cities second main point is that the TAPAS model makes use of a technique which has not been verified for the pertinent situation. The only verification of this model has apparently been undertaken in flat terrain in North Dakota. Such terrain is not a suitable location for verifying a model used in the rough terrain situation of western Colorado. (33)

Finally and perhaps most fundamentally, the model results are questionable because they attempt to analyze the situation outside the realm of modeling practice, that is, a near zero wind speed. A careful analysis of the SEIS and the its backup document indicates that most of the extremely high 24-hour $SO_2$ standards violations, to use an example, are the result of the use of such unrealistic near zero wind speeds. (34)

In the case of the worst supposed standards violation, there was also the compounding factor of use of the model for closein receptors. The type of model is not suitable for closein receptors. The use of near zero wind speeds is enough of a problem in modeling practice as it is.

22

Page 3

Unfortunately, in the case of 24-hour impacts, the model itself apparently has another major problem, in fact, what can only be described as a possible fatal flaw.

The model appears to violate one of the most basic principles of physics, that is the first law of thermodynamics that says, all matter and energy is conserved. To put it another way, the model appears to operate in such a way that the emitted pollutants are brought to a point in space and left suspended but the air which carries them either moves on or disappears. (61)

Such simply does not occur in nature. And hence, the model numbers appear overly conservative. Until such time as such inconsistencies can be removed from this model, it should not be used either in a regulatory fashion or even for descriptive purposes since there appears to be basic problems with its use. Consequently, the air quality impacts listed in the EIS in Chapter 4 and in the summary appear incorrect. Any statements about the so-called no-leasing case as having detrimentally high air quality impacts, especially in the Rifle area, are simply not operative. (34) (248)

Cities Service strongly urges that all such statements be removed from the EIS and that the conclusions of the EIS with regard to such air quality violations be drastically changed to conform to more conventual modeling practice.

Whether it is possible to make such changes and issue the EIS as a final EIS under the proposed time schedule or not, is unknown at this time. However, if it is not possible to make these reevaluations, Cities would suggest that BLM suspend this process until such time as a proper modeling exercise has been undertaken and another draft EIS issued.

Thank you very much for the opportunity to comment on this EIS.

Very truly yours,

THA/RJC-M/134d
cc: Mr. George C. Francis
State Director, BLM
1037 20th Street
Denver, CO 80202

23

Shell Oil Company

Woodcreek
P O Box 2906
Houston, Texas 77001

Jack L Mahaffey
Vice President Mining

September 3, 1982

Oil Shale Projects Team Leader
White River Resource Area
Bureau of Land Management
Department of the Interior
P. O. Box 928
Meeker, CO 81641

Dear Sirs:

RE: DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM

This letter, with attachment, constitutes Shell Oil Company's comments on the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program (DEIS). Comments of a general nature are presented within the body of this letter while specific comments referenced to appropriate page numbers in the DEIS are presented in the attachment.

The Bureau of Land Management is to be commended for its diligent efforts in preparing the Supplemental EIS. Generally, the DEIS indicates a strong attempt to sensibly analyze the potential impacts of future prototype leasing. Several areas of concern have been identified by Shell which are addressed below.

The Supplemental EIS (Draft and Final) is being prepared as part of the decision making process to lease additional Federal lands for oil shale development and not in conjunction with the review of specific lease development plans. Consequently, detailed impact analyses based on specific development proposals have not been possible and in some instances (i.e. air quality, water quality and quantity) worst case impacts have been presented in the DEIS. The final EIS should clearly indicate that actual impacts may be less severe so that the Secretary of the Interior is accurately informed of the potential impacts of additional leasing prior to making final a leasing decision. (4)

Attempts are also made in the DEIS to compare the potential impacts of development on the two lease tracts without the benefit of any detailed development plans. As a result, the two tracts have been "ranked" with regard to the severity of potential impacts. This ranking is inappropriate unless the comparisons are made for specific development scenarios applied equally to both lease tracts. (62)

The cumulative impact analyses presented in the DEIS appear to be based on the assumption that all of the announced oil shale projects, on both public and private lands, in the Piceance Basin will be in production at the time a new prototype lease is brought into production. However, recent actions by oil shale developers appear to indicate a reluctance to proceed with commercial scale development on many of these properties. The Final EIS should reflect the fact that due to the strict diligent development provisions found in a prototype oil shale lease and the current delays in other projects, development of newly leased Federal oil shale may, in fact, precede a significant portion of the other development in the basin. (4)

A final point which needs to be emphasized is the impact which would occur should the decision be made not to lease additional lands under the prototype program. The vast majority of land in the basin depocenter is held by the Federal government and as such has been unavailable for the development of new technologies applicable to the unique deposits located there. This situation exists in spite of the fact that one of the primary goals of the prototype leasing program, as established in 1973, is "to stimulate the development of commercial oil shale technology by private industry". The Final EIS should clearly reflect that failure to lease Federal lands in the depocenter of the basin would effectively block the development of technology applicable to this part of the basin. (63)

We hope our comments will be of assistance in preparing the Final EIS and proceeding with additional prototype oil shale leasing.

Sincerely,

For: Jack L. Mahaffey

SDP:CC

Attachment





SHELL OIL COMPANY
COMMENTS ON DRAFT SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM

1. Page 1 - It is our understanding that discrepancies exist in the total estimated in-place reserve figures for the two tracts. These discrepancies should be corrected in the Final EIS. (64)

2. Page 9 - Statements are made regarding groundwater quality problems including (1) the contamination from leaching of flooded retorts, (2) aquifer mixing due to extraction of the mahogany zone and (3) surface water impacts including reduced flows to Piceance and Yellow Creeks resulting from mine dewatering.

   It should be noted that retorts within the unleached zone would occur where no mobile formation water exists and retorts within the Mahogany zone, through proper design, could be separated from the aquifers by impermeable layers of unretorted oil shale. Also, mining of the mahogany zone may not involve the complete removal of the impermeable stratum separating the two aquifers and mitigation of reduced streamflows could include surface disposal of treated produced water from the mining operation. (2)

3. Page 15 - After release of the final EIS, the Secretary of the Interior will decide whether to proceed with the proposed lease sale and will issue a "Decision Document". Every effort should be made to issue the decision document as soon as possible so that industry can proceed with preparations for participation in the lease sale.

4. Page 16 - Minimum royalty payments based on the estimated recoverable oil shale reserves are required beginning in the sixth lease year. Will the order of magnitude of these payments be similar to the previous prototype leases? When will the actual tonnage figures on which minimum royalties are based be determined and made available? (65)

5. Page 17 - Problems exist regarding the leasing of oil shale on the existing sodium leases currently held by Industrial Resources, Inc. Resolution of these problems and consummation of an agreement between the sodium lessee and the Department of the Interior regarding joint development of the resources should be accomplished prior to the Secretary's decision to proceed with the lease sale. The lease sale should not be delayed by inability to reach an agreement regarding the development of the sodium minerals on Tract C-18.

6. Page 18 - The development of new technologies is one of the primary objectives of the prototype leasing program. Since leasing of C-11 and/or C-18 would be the first opportunity for development of a Federal oil shale lease in the depocenter of the basin, maximum flexibility in the choice of technologies must be maintained. Specification of the type of development, order of development, or relative amounts of mineral products would be inappropriate. (19)

7. Page 19, 78-81 - Specific "committed" mitigation measures in addition to the lease environmental stipulations are listed. It should be noted that the restriction of human activities for a period of four months within critical deer winter range would effectively limit surface activities on tract C-11 to eight months out of every year. The potential impacts of such a restriction on meeting the diligent development requirements of the lease should be fully analyzed. In no event should operations be completed restricted for a four month period out of every year. In addition, clarification is required as to what requirements will control in situations where specific lease provisions conflict with other non-lease committed mitigation measures. (66)

8. Page 23 - Shell's expression of interest stated that Shell would propose to evaluate the development of the unleached zone by in-situ mining and in addition, would evaluate other technologies applicable to other potentially mineable zones. No commitment to a specific technology has been made and Shell would expect to maintain maximum flexibility as to choice of technology and type of development should Shell be successful in acquiring a lease tract. (19)

9. Pages 27-34 - Several references are made to the potential development of a sodium mine by Multi-Mineral Corporation which would impact portions of Tract C-18. The final EIS should be updated to reflect the recent announcement of Multi-Mineral's withdrawal from participating in this development. In addition, the status of the mine plan submitted for development of the sodium leases currently held by Industrial Resources, Inc. and the relationship of this mine plan to development of C-18 should be fully discussed. (4)

10. Page 28 - Tract C-11 contains the U.S. Bureau of Mines Horse Draw experimental mine. Any and all liabilities incurred by the oil shale lessee with regard to this facility should be addressed in the FEIS. If substantial liabilities are involved, the tract boundary shall be redefined to exclude the Horse Draw mine from the lease tract. (2)



11. Pages 33 100, 122, 186 - Conflicting statements are made regarding existing oil and gas leases and operations on the proposed oil shale lease tracts and their relationship to development of the oil shale resource. In certain instances, statements are made that "oil and gas exploration and production could continue unimpeded and temporarily prevent extraction of 72 percent of the in-place oil shale per acre" and that pillars would have to be left around each well to protect its integrity. However, other statements indicate that current oil and gas lease stipulations require that drilling not interfere with mining and recovery of the oil shale. (67)

The specific stipulations found in existing oil and gas leases regarding development of oil and gas and the impacts on oil shale recovery should be fully stated in the Final EIS. In addition, a full discussion of the potential constraints on oil shale recovery due to conflicting oil and gas operations is warranted. The current lessees and the duration of the existing oil and gas leases on tracts C-11 and C-18 should also be identified. (68)

12. Pages 34-35 - We do not agree with the conclusion that large percentages of the resource will be rendered unrecoverable due to development by the various recovery methods. The losses are speculative in nature with no basis stated as to how the unrecoverability figures were calculated. (69)

13. Page 35 - We assume that the statement: "Recovery utilizing true in-situ dissolution mining is presently unknown" refers to the actual production of minerals and not to the existence of an in-situ dissolution recovery method. As stated in our expression of interest, Shell has a patented process which features dissolution and recrystallization of the inorganic minerals and thermal decomposition of the kerogen into shale oil. In addition there is no technical basis for the statement that "recovery should probably be highest by direct mining" with respect to the saline zone, since no recovery method, direct, mine assisted in-situ or true in-situ, has been demonstrated to be applicable to the saline zone on a commercial scale. (70)

14. Page 35 - With regard to soils, it should be noted that the amount of damage is directly related to the technology employed and the tract involved. It is misleading to compare the impacts from leasing C-11 or C-18 when such impacts will depend on the specific technology involved. Conceivably, development of tract C-11 by a true in-situ method would result in less soil damage than direct mining of tract C-18. (62)

15. Pages 35, 68 - With regard to the alluvial valley floors which have been identified in Ryan Gulch and Horse Draw, it should be stated whether formal determinations of their existence and extent have been made and by which government agencies. Further, if it is intended in anyway to limit or disallow development in these areas, the tract should be redefined to include alternative developable acreage. (71)

16. Page 37 - The net energy analysis states that the true in-situ method would be the least energy efficient method of shale oil production. While this may be accurate with respect to in-situ development of the leached zone, heat losses may not be as significant in the unleached zone, where mobile formation water does not occur. (2)

17. Pages 40, 42 - The assumption is made that tract development will begin with development of the saline zone followed by recovery from the upper zones of shale. It is equally possible that development could begin with the mahogany zone followed by recovery from the leached and/or unleached zones. Another possibility would include the utilization of two operations at different levels so that production of shale oil would not be restricted by the market limitations for nahcolite. (Note: Comment number 6 also relates to development restrictions.)

18. Page 40 - The statement is made that direct mining of the saline zone must include backfilling of mined out areas in order to maximize overall recovery and allow recovery of the upper shale zones. It should be noted that recovery from the upper zones first may obviate the need for such support. (19)

19. Pages 41-42 - It should be emphasized that virtually all the surface impacts from a "true in-situ" operation are temporary in nature and that restoration of the surface can proceed contemporaneously with new development. (11)

20. Page 43 - Oil shale leases are currently limited to 5,120 acres by provisions of the Mineral Leasing Act of 1920. However, since a combined alternative of leasing two tracts totaling 10,240 acres has been analyzed, leasing one tract larger than 5,120 acres would be possible should the Act be amended prior to issuance of the lease sale notice.

21. Page 45 - We know of no convincing reasons for delaying or phasing the lease sale beyond the proposed March 1983 date. The development of technologies applicable to the saline zone would only be further delayed should the proposed sale be postponed.



22. Page 64 - Oil shale room and pillar mine plans have been developed based on conditions found in the southern portion of the Piceance Basin. Little information and no experience is available concerning direct mining of the mahogany zone or other potentially minable intervals in the center of the basin. Therefore, possible recovery rates are unknown at this time and must await detailed evaluation including extensive rock mechanics analyses. (72)

23. Page 75 - With regard to hydrologic information for the Piceance Basin, it should be noted that Shell Oil Company holds some water rights on the White River, and is actively involved in the White River Study group concerned with future developmental impacts on the White River drainage.

24. Pages 109 - 122 - With regard to the predicted impacts on air quality from new sources in the Piceance Basin, several discrepancies were brought to the attention of the Bureau of Land Management at the public hearing held in Denver on August 24, 1982. In particular, it was noted that the proposed Superior project was located in error and that the inclusion of impacts from new programmatic Federal leases was inappropriate. Corrections should be made in the final EIS. (14)

25. Page 123 - We fully agree that combinations of various technologies may be possible and that such combinations could result in overall higher resource recoveries. Precise development scenarios are impossible to predict at this time and must be based on complete evaluations of the leased tract(s).

26. Page 124 - We agree that postponing the proposed lease sale in hopes of a technological breakthrough is unwarranted. Indeed, delay of the sale may virtually eliminate the chance to develop technologies applicable to the shale zones only present in the basin depocenter.

27. Page 133 - With regard to the potential for aquifer mixing as a result of mine development, it should be noted that direct mining of the mahogany zone may not result in complete removal of the impermeable stratum separating the two aquifers. The mahogany zone in the depocenter of the basin is substantially thicker than that found in the demonstration mines in the southern portion of the basin. (2)

28. Page 137 - It should be stated that the projected impacts on the White River resulting from lease development represent a worst case due to the assumptions that four barrels of water would be consumed per barrel of shale oil produced and that all of the water would be removed directly from the river.

312



29. Page 186 - It is stated that the assignment of the existing sodium lease would be announced in the lease sale notice at least 30 days prior to the lease sale should tract C-18 be offered for sale. While such a notice is appropriate, it is imperative that the government obtain an agreement to assign from the sodium lessee as soon as possible and announce in detail the agreement in a public notice.

30. Page 211 - Section 12(d) of the Oil Shale Lease states that all water rights developed through operation on the leased lands immediately become the property of the lessor. It should be clarified that this clause is only applicable to water rights developed on the leased lands and not those developed off-tract in conjunction with lease operations. (2)

31. Page 211 - Section 13 of the Oil Shale Lease states that in-situ development should not cause induced fracturing to extend to within 100 feet of the lease boundary. Induced fracturing should be defined to exclude microfractures inherent in the oil shale which may be utilized during in-situ development but would pose no threat to the off-tract resources. (73)

32. Page 212 - Section 18 of the Oil Shale Lease restricts the work day for underground workers to eight hours. As this is a statutory requirement (Mineral Leasing Act of 1920), there is no need for it to be included as a lease term and the lease should be modified to remove it. (74)

33. Page 212 - Section 19 of the Oil Shale Lease requires the lessee to permit access to books, records and accounts to the Secretary of the Interior and the Secretary of Labor to ascertain compliance with Labor Department rules, regulations and orders. We question the need for such access by the Secretary of the Interior for these purposes since only Labor Department rules, regulations and orders are involved. (75)

34. Page 231 - Section 9(E) of the Oil Shale Lease Environmental Stipulations requires the lessee to maintain 200-foot buffer strips on each side of a stream in a natural undisturbed state. It should be clarified that this requirement only applies to perennial streams and not to the many ephemeral drainages which are found on the lease tracts. (2)

35. Page 236 - Section 14(E) of the Environmental Stipulations refers to slurry waste disposal. It should be noted that a nahcolite slurry which might be utilized in in-situ development (e.g., Shell's expression of interest) should not be considered within the definition of waste slurry. (76)



36. Page 247 - The definition of "baghouse" found in the glossary should be clarified to indicate that such pollution control equipment is normally "designed" to filter particulates at over 99% efficiency. (6)

37. Page 248 - The definition of "hydrocarbon" found in the glossary, while chemically correct, includes only pure compounds while in reality the term is utilized to include many compounds which also include other elements, such as nitrogen, sulfur and arsenic.

EDITORIAL COMMENTS (Corrections and/or comments shown in parentheses)

Page 3 - The No Action Alternative examines the impacts of development that may occur without tis (this) leasing.

Page 16 - The royalty rate for shale oil under this prototype program would be 12 cents for each ton of oil shale mined for processing that contains 30 gallons for (of) shale oil per ton of material.

Page 58 - Severe weather conditions such as tornadoes, floods, damaging hail and winds (this is an incomplete sentence). (6)

Page 75 - In general, water in the upper aquifer is of better quality than the lower aquifers (aquifer).

Page 101 - Reclamation would closely follow disturbance which involves on several types of soil and vegetation. (needs to be restated)

Page 123 - The leached zone would generally not be ameanable (amenable) to direct mining...

SDP:CC
9/3/83

24

Oil Shale Projects Team
BLM White River Resource Area
P.O. Box 928
Meeker, Colorado 81641

This is in response to the BLM's Prototype Oil Shale Leasing EIS.

I believe there is no need or rationality for further oil shale leasing as, 1) the objectives haven't yet been met on Rio Blanca and Cathedral Bluff ventures. 2) Technology is not yet developed enough to be proven efficient, let alone environmentally sound or has it been proven economically feasible. 3) Wait untill we have efficient, environmentally, economically sound ways to extract oil from shale, or untill we find more productive resources. 4) The established people of the area do not need the bust and boom economy or the socio-economic problems that come with such a venture. 5) Large game and non-game populations would be greatly affected. 6) There would be the problem of top soil being lost. 7) Huge amounts of water would be taken from an already arid west. 8) Finally, the oil shale leases are not practical these leases are being sought under the pretense of boosting industry and creating jobs, which would be slow in developing. Jobs could be created immediately instead in alternative energy research and development. There is also other sources of oil available at this time with out the need for developing oil shale at this time.

For these reasons, I feel and believe oil shale leases are impractical and unneccessary. New ways of looking at energy needs should be approached, other then the oil shale avenue. Please take these issues into consideration when making the decision on the leases.

Sincerely, one of the many concerned citizens of Western Colorado.

Lisa Dancing Bird — Box 564, Glenwood Springs
Debbie Gonzales — 903 Bennett #1 Glenwood Spgs Colo
Jeanette Pearson — 403 Bennett # 5 Glenwood Spgs Co 81601
Veronica Kay — 417 E 23rd Glenwood Spgs CO 81601
Pat Cavanaugh — 903 Bennett St. B3 Glenwood Spr. CO 81601
Rich Stocker — 903 Bennett, Apt. B3 Glenwood Springs, Colorado 81601
Doug Evans — 4908 154 RD Glenwood Springs CO 81601
Guy Mason — P.O. Box 564 Glenwood Springs 81602

24

Jacque Prell — 814 Bennett Glenwood Springs
Suz Shosie — 818 Blake G.S.
Robert Silverstein — 814 Bennett G.S.
Scott H. Biggers — 9/2 1108 PITKIN G.S
Dean Peabody — 9/2 1108 Pitkin G.S.

Sept. 4, 1982 **25**
Colorado Springs, Colo.
80903
409 N. Cascade

oil Projects Team Leader,

I adamantly oppose any oil shale development on Colorado's Western Slope. I feel the environment should not harmed or destroyed in any way. Colorado is a most beautiful state. For the natives and the tourists I would not like to see any damage to our environment.

The nation does not need the oil from the shale.

There is oil and natural gas in Colorado and elsewhere.

**25**

I would not want Colorado's scenery and environment damaged in any way.

Sincerely,

Barton Hibbard

26

817 Pitkin
Glenwood Springs, CO
Sept. 5, 1982

Dear Mr. Singlaub,

After reading the Draft EIS for the Prototype Oil Shale Leasing Program, I understand that there are several reasons that the BLM might offer additional tract(s) for lease for oil shale development. However, after reviewing the original goals of the prototype leasing program, I can also see that not all of these goals have been sufficiently met to warrant the sale of additional lease(s). (16) Air and water quality are important issues to those of us living in the area surrounding possible lease sites. Since adequate "environmental safeguards and restoration techniques" have not yet been fully developed and we in the area are still not assured of clean air and water, let us not rush into the sale of more leases now.

Sincerely,
Thelma Zabel

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27

**RIO BLANCO COUNTY DEPARTMENT OF DEVELOPMENT**
Rio Blanco County Courthouse
Post Office Box 599
Meeker, CO 81641
(303) 878-5081

7 September 1982

John Singlaub
Oil Shale Director
Bureau of Land Management
White River Resource Area
Box 928
Meeker, CO 81641

Re: Prototype Oil Shale Draft EIS

Dear John:

Enclosed is an additional statement from Rio Blanco County to be entered into the official record on the Prototype Oil Shale Draft EIS. These comments are a supplement to the comments the BLM received from Rio Blanco County at the Public Hearing August 25, 1982.

We recommend that the following lease stipulation be considered for any future oil shale leasing the BLM undertakes:

The lessee shall prepare and submit to the BLM concurrently with the filing of its mine plan, a socio-economic and transportation impact mitigation study, concerning offsite aspects of the proposed development, which will include a factual statement of the following:

(1) The estimated number of employees the specific lease operation will require during its phases of construction and operation; the estimated multiplied population attendant to that employment; and where that population is anticipated to reside.

(2) Based on information acquired in consultation with state and local government, an analysis of the estimated effect of that population influx upon the county and community infrastructure, including:

(a) the transportation system at the county and local level,

(b) the domestic water requirements,

(c) the domestic sewage treatment facilities and collection system requirements,

27

John Singlaub
Page 2

(d) the requirements on the education facilities,

(e) the requirements the new population will impose upon the fire and police protection systems,

(f) the requirements that the additional population will make on local government service systems, with primary emphasis upon the normal public works of both county and municipal governments,

(g) the requirements on the human service system,

(h) the requirements imposed upon the parks and recreation system, and

(i) an estimate as to the need, by type and amount of housing which the new population will require on a community by community basis.

(3) A statement of the immediate impacts and long term effects of mining on transportation facilities within the county, including:

(a) the estimated transportation mode(s), route(s), and frequency of trips for the extracted resource,

(b) contemplated construction of transportation facilities,

(c) the estimated effect of any truck movements on the rate of roadway pavement deterioration, on the design life of the transportation mode, on the level of service repair and on overall safety to the motoring public, and

(d) a discussion of those measures which can mitigate impact on those transportation modes such as proper signing, lighting, and design or access to and from public roadway(s).

(4) A statement of the perceived roles and responsibilities of the lessee, the affected local governments, and the State of Colorado, relating to the technical and financial needs of the affected communities.

A determination for completeness will be made by the BLM. The Bureau will make this impact mitigation study available to the State and local governments. (77)

The Lessee shall comply with all valid and applicable laws and regulations of Federal, State, and local governmental authority.

Rio Blanco County requests that as part of any future leasing decisions the BLM would require all lessees to meet all requirements of the county permitting process prior to the issuance of the federal permit. (78)

Sincerely,

Mark Bubriski

Mark Bubriski
Rio Blanco County
Impact Coordinator

MB:ta

28

**GARFIELD COUNTY Board of County Commissioners**

P. O. Box 640 Glenwood Springs, Colorado 81602-0640 Telephone (303) 945-9158

FLAVEN J. CERISE JIM DRINKHOUSE LARRY VELASQUE.

September 7, 1982

Mr. John Singlaub
Oil Shale Projects Team Leader
BLM, White River Resource Area
P.O. Box 928
Meeker, CO 81641

Dear Mr. Singlaub:

In response to the draft EIS on the Prototype Oil Shale Leasing Program, the Garfield County Commissioners would like to once again register their concerns regarding the possible issuance of additional oil shale leases on federal lands in northwest Colorado.

Now, with the possibility of leasing Tracts C-11 and C-18, the concerns center around the phasing of their development and the input that local elected officials will be allowed regarding the socioeconomic effects of such leasing. Oil shale development on federal land, in addition to that which is already being planned and developed on private lands in Region 11, could mean adverse socioeconomic impacts in local government jurisdictions. With four oil shale projects in the early phases of development in Garfield and Rio Blanco Counties in 1981, some local government jurisdictions in Garfield County were experiencing annual growth rates near 100%.

The Board therefore requests that local governments be given the opportunity to provide significant input into socio-economic impact mitigation programs which should be required as conditions of the leases. (77)

Sincerely yours,

Flaven J. Cerise
Chairman
BOARD OF COUNTY COMMISSIONERS

FJC/ewc

cc: Robert Burford
George Francis

**Cathedral Bluffs Shale Oil Company**
P O Box 2687 Grand Junction Colorado 81502

September 7, 1982

Mr. John Singlaub
Oil Shale Projects Team Leader
BLM White River Resource Area
P. O. Box 928
Meeker, Colorado 81641

Dear Mr. Singlaub:

The following comments are in response to your request for public comment on the draft prototype Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program. These comments are in addition to and also contain further details to oral comments presented by Robert Thomason in behalf of Cathedral Bluffs Shale Oil Company, the lessee for prototype lease Tract C-b.

Cathedral Bluffs supports the continued development of the prototype shale oil leasing program with its goals of developing an environmentally acceptable oil shale industry and technology demonstration. In addition, we feel that the general leasing program details should be in place ahead of the demand for leases. Once the demand occurs, which could happen overnight due to any number of foreign developments, the resource would be readily available for early production.

Our specific major concerns regarding the Draft Supplemental EIS are in the interpretation of the air quality and water quality data which result in predicting particularly negative impacts. We feel that this has caused unnecessary citizen concern, particularly for those who do not have the available expertise to recognize these problems. The following are our specific comments:

1. AIR QUALITY - (Chapter IV)

A. Model Inputs - Worst Case Assumptions

On page 104 the worst-case model assumptions utilize an input west wind at 4 meters/sec., F stability, which is assumed to be invarient for a total of 24 consecutive hours. The Cathedral Bluffs Shale Oil Project (CB) has conducted an indepth meteorological assessment of its 2-year baseline and found that no persistence was ever attained for F stability with west winds over 10 hours. If this were utilized in the present EIS modeling, results would be reduced to 10/24 of the stated values. Applying this ratio to Table IV-2 (24-hour Predicted Pollutant Concentrations - 2003 High Level Mine assisted In-Situ Scenario) would reduce all the stated exceedances of $SO_2$ to levels which comply with applicable PSD standards. (79) (80)

All too often worst-case inputs are assumed for modeling which are so far removed from reality that they exceed both good statistical analysis and the requirements of the Clean Air Act. Coupled with this is the fact that non- modellers are not familiar with all the limitations of both models and uncertainties in their inputs. Unfortunately, the public





often only sees the bottom line predictions that the proposed project will exceed certain regulatory levels of pollutants resulting in serious negative impacts on air quality. Modeling limitations need increased emphasis; a range of ambient concentrations is suggested in the tabular outputs reflecting modeling uncertainties rather than one discreet value. (32) (81) (82)

B. $NO_x$ Values Cited

The only model runs in the EIS document are for 24 hours. The only existing standard for $NO_x$ is an annual standard. Almost always, 24-hour modeling values are higher than annual standards; it is erroneous to compare the two, but this is exactly what the document has done. Increments and standards based on 24 hour periods or less are of questionable value, except where they are specifically health related and have suitable documentation. (83)

C. Model Use

The TAPAS model is one of the more elegant and useful models in existence and its developers some of the more capable modellers. Nonetheless, TAPAS has not been specifically validated for the Piceance Basin, nor is it an EPA Guideline model for utilization in permitting or compliance functions.

In PSD applications the EPA suggests use of screening models such as the Valley model be utilized first. Then, only for those conditions that result in high ambient concentrations, runs with more accurate and less conservative rough terrain models such as TAPAS are made to show that standards are not violated. Such procedure was not followed in this EIS. (33) Furthermore, it must be noted that in cases where specific meteorology does not exist, EPA Region VIII uses F stability at 2.5 meters/sec. as a worst case and not the 4 meters/sec. used in the draft document. If this is input to the Valley model, it calculates hourly concentrations and on the basis of a 6-hour wind persistence divides results by 4 to obtain a 24-hour value. Applying this result to the present EIS, values would be 6/24 or 1/4 of those stated in the tables. (84) Also, regarding model use, no annual results are presented, representing an omission on the EIS. (85)

D. TSP "Problem"

The EIS states that nearly every town in the study area already violates the TSP standard. It did not clearly state that such violations, in most cases, are due to fugitive dust and home wood burning. It is likely that pollutant dispersion patterns from the various developments will not intersect to significantly impact the TSP situation in those areas. (86)

In conclusion, the stature of the EIS would have been enhanced had a more realistic worst-case been selected and modeling results acknowledged to contain a range of uncertainty. Another current basin impact analysis states that this uncertainty may be as high as a factor of 10 for 24 hour cases (SAI, Latimer et al 1982, Air Quality Impact Analysis of Synthetic Fuel Development in the Unita (32) (82) (87)

Basin, prepared for BLM.) Indeed this establishes the fact that we are asking models and modelers to step well beyond the state of the art. Moreover when we attempt to predict with these models impacts that are 50 kilometers and more distant, when we know predictions even 10 kilometers are questionable, it is an exercise with no credibility.

2. HYDROLOGY - (Chapter IV)

The simple two aquifer system with open vertical communication between aquifers as generalized from the references used in the Draft EIS is not only inaccurate but produces many erroneous conclusions. The actual field monitoring and data demonstrates a far more complex system. There is a preponderance of evidence that the system is multilayered and highly confining. Permeabilities in the vertical direction are orders of magnitudes lower in the vertical direction than in the horizontal direction. Moreover horizontal permeabilities are extremely low. Strong evidence also exists that there is definitely not complete or even much connection between all but the very shallowest bedrock aquifers and the surface streams. If there were a complete hydrologic connection between aquifers (as stated in the draft EIS), the entire system is already co-mingled as a result of nature rather than development! For much of the basin, particularly near the C-b Tract, we know co-mingling does not exist because the major aquifers differ significantly in quality. (88)

Regarding the subject of leaching flooded retorts, should they ever be flooded, there is now actual information on the nature of modified insitu retorted shale. These data indicate there are mineral changes brought about by the retort process and by the subsequent contact with ground water which reduce the impacts, if any, on groundwater. In particular we refer you to Peterson and Wagner's work at Los Alamos National Laboratory. Subsequent to their June 1981 report, new tests by the authors using ground water for the leaching experiments found that many of the minerals described as mobile in the 1981 report became fixed. These data provide an explanation for the field results being obtained at the Occidental Logan Wash test site which show that the quality of effluent water from spent retorts is returning to the ambient levels of groundwater in the nearby oil shale formations. (89)

Scientific evidence suggests that the rate of water transport in the oil shale formation is orders of magnitude slower than 20-30' per year set forth in the Draft EIS. The measurement is far more likely to be on the order of hundreds of years per mile. This evidence and thesis are set forth in J. H. Birman's paper presented at the last oil shale symposium at the Colorado School of Mines. (90)

For some time CB has been working with Dr. James Taylor of the USGS in conjunction with development of the USGS basinwide groundwater model. Our opinion is that this model in its present form cannot be used to accurately predict impacts. The primary reason is that it assumes open vertical communication between the main surface streams and the bedrock aquifers and that these aquifers provide for the base stream flow. These assumptions are contrary to actual field data. In fact, actual evidence indicates the opposite to be the case. Therefore to even make worst case predictions at (91)



this point using this model cannot be logically or scientifically justified.

We do concur with your comment that mine drainage and dewatering is a complex process and actual rates will only be known when the mine development process begins. Some data concerning this matter are now available and has been provided to the USGS and Dr. Taylor along with suggestions to revise the USGS model assumptions.

In conclusion, there is sufficient data available now on the nature of MIS spent shale, and the complexing reactions which take place when the retorted shale is exposed to ground water. When this data is further modified by dilution, diffusion theories and the confining nature of the formations, they support a no impact prediction. Conversely, at present there are no data to support the negative worst case impact suggested in the Draft EIS. (92)

3. OTHER AREAS OF CONCERN

A. Net Energy (Chapter IV)

In the final paragraph of this section the Draft EIS cites an additional credit for usable energy in the form of product gas. In the case of mine assisted insitu (MIS) this appears to be greatly underestimated. The net effect in the E out to the overall ratio could be substantial because the MIS product gas processing would generate all the project's input needs and at some times have a surplus for export to the power grid. (2)

B. Range/Reclamation/Wildlife Comments

In Chapter III, the EIS makes introductory statments that spent shale waste will involve both surface and underground disposal. Other than mine assisted insitu (MIS), at the present time underground disposal is only being considered as an experimental alternative to surface disposal as the most practical and feasible method. The EIS is rather misleading in this introduction, and in a later chapter to imply that underground back filling of spent shale is a viable alternative since the cost will likely be prohibitive. (93)

The discussion in Chapter III on reclamation of above ground shale disposal embankments, and statements in Chapter IV, p. 128 and 190, appear to limit the reclamation strategy of the proposesd tracts to covering embankments with at least 24 inches of topsoil. Since existing topsoil depths average only 15-18 inches on natural areas where disposal will take place, alternative reclamation strategies may need to be employed. This may be especially true due to the potentially prohibitive cost of obtaining and transporting topsoil material from an outside source. Disturbing additional acreages on tract to obtain topsoil doesn't seem feasible since these areas would also require topsoil salvage for their reclamation (that is, the same soil can't be used in two different places). (94)

The EIS does little to provide the reader with information about alternative reclamation methods. These different strategies could

include such practices as controlled leaching of soluble salts to a point below root zone; applying N & P fertilizers; using a capillary barrier such as a compacted layer of fines; incorporating sewage sludge into upper layers of spent shale; and using different types and amounts of mulches (to reduce surface temperature and evaporation). A combination of methods and soil amendments will provide successful reclamation. These alternative strategies need to be addressed in the EIS. (2)

Revegetated spent shale embankments and disturbed areas may be dominated by perennial grasses and forbs during early years following seeding. In later years (6-7 years following seeding) a change in species composition from a dominance of perennial grasses and forbs to a dominance of shrubs could be expected (Kilkelly, Berg, and Harbert. "Field Studies on USBM and TOSCO II Retorted Oil Shales: 1977 - 1980. 1982 EPA Publication). Species composition in the long term may be effected more by grazing management practices than any other factor. A good management plan will be needed to assure long term revegetation success.

The section on grazing in Chapter IV points out that not all areas will be a disturbed state and thus lost to grazing and wildlife habitat use for the entire life of the mine. This section also states that forage production could be increased for several years following mining. The EIS does not mention that reductions in grazing capacity due to impacts of development could be offset through different mitigation treatments. Such treatments could include: 1) opening up big sagebrush/pinyon-juniper communities through eradication of dense stands (brush beating/chaining/burning); 2) increase forage production and utilization by irrigation and/or fertilization (use of irrigation to dispose of excess mine water during mine development); 3) obtain better utilization of pastures by providing more water developments (storage tanks, water troughs, and springs development); 4) once revegetated topsoil/raw or spent shale storage embankments have become stabilized (5-6 years) these could be opened to grazing; these areas can be 3-4 times as productive as the existing range. These are just a few examples of mitigation practices which have been undertaken at the C-b Tract with varying degrees of success (see C-B Annual Reports 1979 - 1981). It might be interesting to compare lost land from ski area development vs. shale oil development. (2)

C. Additions to the Lease and Environmental Stipulations

1. Regarding the Baseline Assumptions in Chapter I, we have some questions concerning the recommended additions to lease stipulations. To mitigate a main concern, these stipulations appear to create more serious problems. In addition, the wording lacks definition.

   a) On page 19, concerning human-disturbance restrictions on critical deer winter range:

      What size limitations will be set. For example, is the limitation to be 200 yards from the area or 1/2 mile? According to the map on page 80, a large number of acres could possibly be restricted during the winter months. (95)



   b) Also page 19, there is a statement prohibiting adverse impacts on deer or elk migration routes.

      With regard to deer fences, fencing has been suggested as a way to reduce deer-vehicle collisions. Fencing under this scenario could be considered detrimental to deer in the Basin since it restricts movement across the highway. Obviously this is in conflict with the benefit derived by protecting the large wildlife from road kill. (96)

   c) Page 19, "The nests interfere with resource developmnent or recovery operations."

      What constitutes interference? It implies that any nest that cannot be disturbed would be interfering with the recovery operation which certainly is not true. (2) (97)

2. Regarding Chapter II Alternatives, we have the following questions.

   a) Page 33 regarding the statements about short term loss of habitat and carrying capacity of deer:

      What is the basis for these figures? Regarding reclamation activities and mitigation projects, the carrying capacity would not necessarily be reduced. The entire 36,000 acres would not be disturbed at one time, therefore the short term losses should be even less. (98)

   b) Page 37. The statement regarding the difficulty of establishing mature shrub and tree species on spent shale piles is not true. Study plots at Colony (11 years old) and Sand Wash (8 years old) show that shrub species can be established and mature growth forms attained on processed shale. Through the use of proper reclamation techniques, species selection, and watering, various shrub species can be grown on processesd shale. (99)

   c) Page 141. "Provide lined impoundments between the spoil pile and stream channel"

      The design criteria for lining should be specified and justified appropriately. (100)

3. Regarding Chapter IV, we have the following questions and comments:

   a) Page 149. Regarding the statement that shrub production is a limiting factor on the Piceance deer herd:

      If browse is considered a limiting factor for mule deer then what mitigation alternatives are being studied? Possibly only certain species are limiting. These species could be used in the reclamation plans to improve the habitat. (101)

b) Page 150. Regarding the statement that both reclamation and mitigation projects are needed:

This is a good idea, but who is going to recommend the type and extent of mitigation projects necessary? Some method of analysis for measuring success of these projects must be developed. These projects should be coordinated so that mitigation will not result only in isolated patches but rather will be basinwide. (102)

c) The statement on page 151 concerning human disturbance on deer and elk. It seems that the 0.1 mile buffer zone may have to be more variable; for instance, it may have to be larger in open areas and less in canyon areas. (103)

d) Page 151. With regard to the deer/vehicle collision problems:

We agree that with the increased traffic load the deer/vehicle collisions may increase, but there are several mitigation options which could reduce the roadkill. For instance: public awareness programs (slide shows, signs), busing, deer reflectors and possibly a railroad. It should be noted that weather conditions and snow depths may have more effect on the roadkills than the volume of traffic. (2)

e) Page 155. Regarding the factors hunters found enhancing.

It does not seem the oil shale development is going to hurt the solitude factor; those tracts are already overrun by hunters during the hunting season. (104)

f) Page 189. "Wildlife habitat lost on 310 to 2290 acres due to urban expansion and road construction will be irretrievably lost."

Depending on where this expansion was located the habitat acreage removed may not be such a significant impact, for example building in mule deer winter range vs. saltbrush flats.

g) On page 190, concerning the section on wildlife mitigation:

The various companies and agencies are already implementing some of these suggested programs including a brush mitigation project, deer reflector study, and collection of roadkill data. Several questions that should be asked are: What guidelines will be used to operate the trust fund? Will it be a one time contribution or yearly? How will the selection of mitigation projects be made? Will all companies and agencies involved in habitat disturbance be required to participate and provide funds? Should these projects have to be restricted to the Piceance Basin? For example, what about improving the summer range outward to Piceance Basin? Finally, before a contributory or tax program could be imposed on the developers, a cost/benefit analysis must be required. We cannot continue to add such costs along with tax burdens on the developers. Rather, since the benefit is to the public, they must also bear the burden. (105)



4. Regarding "Due Diligence"

As with the existing leases, "due diligence" is defined in Section 10 as production at various levels consistent only with compliance with the lease terms (page 209, Appendix A). It is respectfully suggested that since mine development may well take ten years plus the two year baseline period, that the lease take into account conditions extraneous to the lease terms themselves in determining whether a lessee is proceeding with due diligence. Examples of such factors are construction costs, oil prices, general economic conditions and the like.

This suggestion does not embrace new legal concepts. As an example, Colorado water law requires diligent development of the water right in order to avoid speculation but this doctrine does not require a water right owner to allocate precious resources to such development at times when such development would be unwise. The purposes of the prototype program will best be met if due diligence is used to prevent speculation (the bonus bid program together with actual on the grounds that lessee-invested improvements already do this), but not to override sound business judgment. (106)

5. With regard to any changes in the existing prototype lease, it is pointed out that specific changes would require detailed review by the lessees and should not be subject to the closing date for this EIS. (107)

With particular regard to the Air and Water Impacts sections, we would be pleased to work with BLM's technical people to resolve the interpretive elements of these issues more accurately. If you have any further questions concerning our comments, please contact Robert Thomason, 303/244-3222.

Very truly yours,

CATHEDRAL BLUFFS SHALE OIL COMPANY

R. E. Thomason

R. E. Thomason, Vice President
Environmental Services

WHL/RET/pmr

**GSi**

September 4, 1982

Mr. John Singlaub
Oil Shale Projects Team Leader
BLM White River Resource Area
P.O. Box 928
Meeker, Colorado 81641

Dear Mr. Singlaub:

I have read with great interest the hydrology section, Chapter IV of the Draft Supplemental EIS for Prototype Oil Shale Leasing Program, Summer 1982. I have some comments which I hope you will accept in the light of our continuing investigations of Piceance Basin hydrology.

The EIS is a fine statement about a complex subject worked on by many highly qualified professionals from the public and private sectors. As would be expected, opinions differ regarding the hydrologic processes and the environmental implications resulting from the mining of oil shale. While what I have to say results from recorded data and direct field observation at these facilities and elsewhere in the Piceance Basin, I owe much to the professional colleagues from both sectors. Some agree and some do not agree with these opinions.

The key question - far more significant than any other aspect of the hydrology - is the extent to which the bedrock aquifers are in communication with the streams and springs in the Piceance Basin. The possibilities are: completely, somewhat, and not at all. The choice among these alternatives generates the hydrologic model, and this in turn determines the baseline and development monitoring facilities, operational design, and mitigation measures.

The EIS states that there is "complete", and later, "perfect" communication between the bedrock water and the streams. If this is true, it must logically follow that:







1. The entire ground water system is already contaminated by cross-flow and mixing due to natural processes. It can make no difference where and how drillholes, shafts, and underground retorts are constructed. The anticipated impact on water quality is unreal.

2. There are no confining layers within the bedrock system. The retort interval cannot be isolated.

(108)

It seems, therefore, that the measures proposed by the EIS are inconsistent with the basic assumptions.

I think no-one would accept either perfect continuity or perfect vertical restriction of the bedrock water. The consensus is that communication is limited. Some workers believe that there is much ground water flow across the bedrock formations, providing significant recharge to the streams. Others, and I am among them, believe that except where there are great through-going faults, there is very little communication between the bedrock aquifers and the surface. If the views that I represent are correct, careful mining in and beneath the Mahogany Zone of the C-b Tract should be possible without hazard to the usable ground water, the springs, and the streams.

There are several other points on which I disagree with some of the statements in the EIS: Except where the lower aquifer is exposed, I know of no springs that are demonstrated to derive their recharge from the lower aquifer; (2) Because hydrocarbons are removed and refractory minerals are created, leaching of the spent shale in the retorts may be less hazardous than leaching of the natural rock; Depending on a number of factors still to be quantified, rates of transport in much of the bedrock system may be significantly lower than the 20 to 30 feet per year in the upper aquifer as stated in the EIS. (90)

This letter would be much too long if it contained the data and the arguments on which the foregoing statements are based. I am enclosing a copy of a position paper: Some Questions on Piceance Basin Hydrology which I gave at the Fifteenth Oil Shale Symposium held at the Colorado School of Mines on April 28-30, 1982. That does provide the information as a set of working hypotheses and alternate interpretations subject to modification as we learn more about the Basin. It is for your interest and not intended for inclusion in the final EIS.

30

Page three

Mr. John Singlaub
September 4, 1982

I would be pleased to discuss any of these statements with you and your colleagues.

Sincerely Yours,

GEOTHERMAL SURVEYS, INC.

J.H. Birman
President

31

Associated Governments of Northwest Colorado

moffat
rio blanco
garfield
mesa

September 7, 1982

The Oil Shale Projects Team Leader
U. S. Bureau of Land Management
P. O. Box 928
Meeker, CO 81641

SUBJECT: Comments of Draft EIS for the Prototype Oil Shale Leasing Program

Dear Sir:

These comments are submitted on behalf of the local governments in Region XI of Northwest Colorado. The draft EIS for the proposed prototype oil shale leasing program indicates that there will be serious socioeconomic impacts in the Towns of Meeker and Rifle and the counties Rio Blanco and Garfield.

It is essential that these governments in our Region be assured an adequate process to address these impacts such as now required for the federal coal leasing program. It is strongly urged that the identical process now used for the coal leasing program be adopted for the oil shale program. Any lease should set forth that the lessee "shall comply with all valid and applicable laws and regulations of federal, state and local governmental authority." (78)

Thank you for your consideration of these comments.

Sincerely,

Jim Evans
Director

JE:df

xc: Mayor Darold Hedenscog, Meeker
Mayor George Mitchell, Rifle
Chairman Flaven Cerise, Garfield County
Chairman Allan Jones, Rio Blanco County

BOX 351 RIFLE, COLORADO 81650 TELEPHONE 303-625-1723

32

September 7, 1982

Oil Shale Projects Team Leader
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, Colorado

Dear Sir:

The enclosed comments are submitted for your consideration for the final EIS for the Prototype Oil Shale Leasing Program. It was impossible to meet the deadline, but as some of the comments have to do with errors in data used in the DEIS, I hope you will give them your attention nevertheless.

Thank you for the opportunity to contribute to this process.

Lillian Valenzuela

Lillian Valenzuela

cc: Monte Pasco
Dept. of Natural Resources

J. Pendleton
Mined Land Reclamation Bureau



32

Re Yellow Creek Instantaneous Discharge September 7, 1978.

I call your attention to a misprint of information on page 73 and 76 of the Draft Environmental Impact Statement. The text quotes high maximum daily sediment discharge from Yellow Creek (Tract C-a is in its headwaters) for period of record 1975-1980 as being 90,000 tons/day. USGS Water Resource records show a high maximum daily sediment discharge for that period as 290,000 tons/day on September 7, 1978. This was the same day as the maximum daily flow of 6,800 cfs mentioned on page 67 of the DEIS. These are extreme fluctuations from the norm for that historically small stream. The DEIS text explains the 6,800 cfs discharge figure as an example of runoff potential from "high intensity localized thunderstorms," but the normal average daily flows range from a fraction of one cfs in the winter to 2-4 cfs during spring runoff months, with a former peak record of only 100 cfs. There was no rainfall recorded at Grand Junction from September 1-6, and .043 inch on September 7, 1978. Further underscoring the abberrant nature of the event is the fact that flows ceased entirely in Yellow Creek following the 6,800 cfs discharge, from Sept. 11-16 (summary data for the year says flows ceased immediately after Sept. 7, 1978); they resumed at a higher than normal rate, with erratic flows for several days. Piceance Creek, which lies within a few miles proximity of Yellow Creek, showed no unusual flows for that day, nor did streams in the southern part of the Piceance Basin. Total sediment discharge for water year 1978 was 290,790 tons/day, 290,000 tons of that occurring on Sept. 7, 1978. Contrast this with total loads of 989 tons/day in 1977, 1,478 tons/day in 1979, and 12,495 tons/day in 1978. (See Exhibits A,B,& C where circled.)

It seems unlikely that the above-described event could be ascribed to "high-intensity localized thunderstorms," therefore, I believe further evaluation and explanation of its possible causes are in order, especially with Tract C-a sited in headwaters of the Yellow Creek basin. Was this a spill from an impoundment or some other system failure? We are, after all, promised 0 run-off; if this has not proved achievable, the affected public has a right and a need to know in order to adequately protect itself. (2)

Anomalous daily sediment flows in Parachute Creek, USGS Water Resource Data for Colorado

Unusually and erratic flows are shown during winter months, traditionally a time of minimum runoff. Flows are often disproportional to sediment load readings. (See Exhibit D and E where circled.)



Surface water supply impacts

Page 9, "Summary," 4th paragraph:
Re White River flow reduction due to development of both Tract C-11 and Tract C-18--The DEIS text predicts that at a mine production rate of 100,000 bbl/day flows of the White River would be reduced about 4% (about 20,000 acre feet/year). However, interruption of the contributing flows of the Piceance and Yellow Creek tributaries, predicted in the DEIS as a cause of mine dewatering and water table drawdown, and possibly due to storage of water from tributaries leading into those streams, could in itself create a deficit of White River flow of more than 20,000 acre feet. The Piceance Basin Spring Hydraulics Investigation, 1978 (referenced in the DEIS) shows a mean annual runoff of 29,272 acre feet/year for the two tributaries, Piceance and Yellow Creeks, period of record 1965-1972. Streamflows increased beyond this for the period of 1973-1977 in the amount of 7,000 mean annual runoff, producing a total of about 36,000 mean annual runoff in acre feet. (The increase appears to have been due to the detonation of a 90 kiloton nuclear bomb in the Mesaverde Formation in the central part of the Piceance Basin south of Tract C-11 and west of Tract (109)
C-b) Interruption of this flow, then, could deplete the White River in that amount.

Additionally, since Colorado water law requires that disrupted water flows be augmented to supply downstream rights, water from dewatering may be used to artificially supply the streams. If mine water if of such poor quality that it cannot be discharged (a likely circumstance at some point as mining progresses) and treatment of it is not practicable, then the White River will be the source to fulfill augmentation requirements. These factors portend withdrawals from the White River of undetermined amounts, but certainly larger amounts than the 4%, or 20,000 acre feet annually, suggested in the DEIS.

(See Exhibit C for 1977-1980 yearly flow and sediment load increases for the four major Piceance Basin streams--USGS Water Resource Data for Colorado. Also, total water budget for the basin has been widely quoted as an average of 70,000 acre feet/year. The last two years shown, 1979 and 1980, show a yearly runoff approaching twice the expected runoff.)

Present and future leasing of gas rights in the Rio Blanco Unit (Tract C-11 and Tract C-11) - State of Colorado 1974 referendum prohibiting withdrawal of gas produced by nuclear gas stimulation.

Following the AEC/CER Geonuclear/Equity Oil Co. attempt to stimulate gas production in the Rio Blanco Unit by detonation of three 30-kiloton nuclear bombs in the Mesaverde formation in 1973, citizens of the State of Colorado voted by referendum not to allow further nuclear detonation for such purposes and not to use gas produced by such means. Gas sampling at the time showed it to contain strontium 90 and tritium as well as other radioactive elements in high amounts. Studies show temperature levels at depths which correspond to the detonation depth to be 200$^{0}$ and over, which implies random movement of the gas by pressure and vaporization. Pockets of water have also been found at these lower strata. The "chimneys" created by the blast have undoubtedly long since collapsed, releasing radioactive elements contained within them.

The wishes of the people of Colorado as expressed by this referendum must be given due consideration before gas production is included as a lease right and before any development takes place. Any current gas production in this area should be halted pending evaluation of health risks to the public and public education and comment.

(110)

Water withdrawals from the deep formations of the Piceance Basin, central portion

Several companies have filed applications for deep groundwater rights in the nuclear detonation area. The same considerations must be made in this regard as for gas withdrawals as discussed above.





Impacts of the 1973 Rio Blanco Project nuclear detonation on the rock structure in the deep layers of the Piceance Basin and implications for mineworker safety and mineral and shale production.

Ben Weichmann, President of Multimineral Corp., reported the following in the 1974 Rocky Mountain Association of Geologists Guidebook regarding pre- and post detonation conditions at the Multimineral lease site, and results of seismic monitoring of the site.

Pre-detonation - "Any oil shale mining operation involving the Lower Zone will have to pass through the overlying Leached Zone. The high effective porosities and salinity of the water will create special problems in mine access and water disposal....the shaft grout curtain will have to be carefully monitored to detect the development of cracks. At depths below 2,000 feet, any cracks in the grout curtain that would allow water to enter from the Leached Zone having high transmissivity would be an immediate threat which could result in loss of the entire operation."

Post-detonation - "The data strongly suggest an alteration of the geologic conditions in the Leached Zone, probably an opening of sealed fractures and voids within the zone....Collapse of certain beds in the Leached Zone may have occurred, as evidenced by the immediate flow of sediment in the water from the flowing well."

Contrast the above with the positive note taken in the DEIS regarding similar problems on the subject lease tracts:

"If mining is to take place only in the saline zone (below the Leached Zone), a shaft could be placed through the upper and lower aquifer and properly sealed with grout and water rings, greatly reducing the amount of dewatering that would be necessary....Pilot holes will have to be drilled to test both the quantity and quality of water before dewatering techniques can be developed (Multi Mineral Corp. 1981).

"The saline zone (explored at the Bureau of Mines shaft) was found to be a very tight formation, containing very little water. If this case holds, a sufficient layer of this zone would have to be left above the mine to prevent inflow of water from the lower aquifer. If water was allowed to flow into the mine there would be a large increase in the dissolved solids concentrations of that water. Because very little is known about the hydrologic characteristics of the saline zone, it is not possible to quantify hydrologic effects from mining, beyond the above discussion. (p. 133)

The Multimineral site lies much further away from the detonation site than C-11 and C-18. What "special problems" might they encounter at this closer range? C-b, which lies about 5 miles to the east of the detonation site, has noted its problems with rock structure in deep mining. Shell Oil Co. before them, pulling out of its partnership on the C-b tract, cited weak rock structure as one of the reasons for its retreat.

From the DEIS, regarding C-11 and C-18: "Tract development would probably begin in the Saline Zone with subsequent production from the upper zone shales, principally the Mahogany Zone..." (p. 40)

"Recovery estimate does not include the leached zone, as generally poor ground conditions caused by solution cavities and brecciation would severely limit application of direct mining methods." (110)

Comments: What does this mean for worker safety--does OSHA have guidelines for dealing with conditions like the above? With resource recovery potential so low by percentage of total deposit on the tracts due to these conditions, can it possibly be economical to employ the refined and sophisticated mining techniques implied by such a combination of weak rock structure and hydrologic conditions? Just how much did the nuclear detonation contribute to these problems and just how much does it factor into resource loss and government compensation?



Additional omissions from the DEIS are listed briefly, but their significance to adequate environmental evaluation is major.

Time context of effects - For example, the DEIS states without elaboration that total dissolved salt concentrations will decrease in certain areas due to mining. This may be true in the lower aquifer, where decreases may amount to 1000 mg/l of seawater levels, which is still pretty salty. It is true in other areas only over the short-term, since leaching over the long-term through underground mines will eventually raise salty discharges to high levels. The mitigation effect in this regard of a backfill of spent shale/cement is not discussed, though this is presented as an optimum ratio. (249)

Subsidence effects: Subsidence potential in relation to water mining is not discussed at all, even though water in the basin has long been a structural component of the basin throughout. Placement of structures, including shale piles, dams, impoundments and reservoirs in the context of potential subsidence is missing. Maybe these engineering problems have been solved, but they appear to be unrecognized issues in the DEIS. All of this is to take place within the confines of the tract, it appears, unless additional land is to be appropriated for waste disposal, dams, etc. Underdrains will be placed in and around shale piles--is the efficacy of such 0-runoff precautions considered in context of subsidence potential due to shale, gas and water mining? (111)

Heat pollution: Will cooling methods under commercial production (2700-3000 tons/hour under Colony's plans) for oil shale heated to 900$^{o}$ be adequate to keep shale waste piles at acceptable temperatures? Will underdrains for streams and run-off be heat protected? What about the potential of heat pollution from steam injection, such as Equity Oil is doing 7 miles west of Meeker, or burning in-situ retorts at commercials levels of production? (112)

Evaluation needed of present damage and changes from baseline from existing operations - See entire preceeding comments for examples.

EXHIBIT A

32



09306255 YELLOW CREEK NEAR WHITE RIVER, CO--Continued

SUSPENDED-SEDIMENT DISCHARGE (TONS/DAY), WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DAY | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) |
|---|---|---|---|---|---|---|---|---|---|
| | | JULY | | | AUGUST | | | SEPTEMBER | |
| 1 | .48 | 35 | .04 | .31 | 30 | .02 | .30 | 30 | .02 |
| 2 | .50 | 40 | .05 | .31 | 30 | .02 | .30 | 30 | .02 |
| 3 | .44 | 25 | .03 | .25 | 35 | .02 | .31 | 42 | .04 |
| 4 | .42 | --- | .03 | .25 | 30 | .02 | .29 | 30 | .02 |
| 5 | .42 | 20 | .02 | .25 | 30 | .02 | .29 | 20 | .02 |
| 6 | .42 | 50 | .04 | .25 | 30 | .02 | .29 | 35 | .03 |
| 7 | .41 | 85 | .09 | .25 | 25 | .02 | 500 | 44000 | 290000 |
| 8 | .41 | 30 | .03 | .25 | 35 | .02 | 4.5 | 10000 | 122 |
| 9 | .41 | 35 | .04 | .24 | 50 | .03 | 1.1 | --- | 5.0 |
| 10 | .42 | 45 | .05 | .22 | 12 | .01 | .40 | --- | .10 |
| 11 | .42 | 35 | .04 | .21 | 16 | .01 | .00 | --- | .0 |
| 12 | .47 | 45 | .05 | .22 | 19 | .01 | .00 | --- | .0 |
| 13 | .33 | 35 | .04 | .47 | 315 | .56 | .00 | --- | .0 |
| 14 | .39 | 60 | .06 | .43 | --- | .10 | .00 | --- | .0 |
| 15 | .34 | 20 | .02 | .39 | --- | .05 | .00 | --- | .0 |
| 16 | .41 | 35 | .04 | .37 | --- | .05 | .00 | --- | .0 |
| 17 | .42 | 25 | .03 | .32 | --- | .06 | .21 | --- | .03 |
| 18 | .43 | 30 | .03 | .32 | --- | .03 | .32 | 58 | .05 |
| 19 | .41 | 35 | .04 | .32 | --- | .02 | .34 | 51 | .05 |
| 20 | .41 | 30 | .03 | .32 | --- | .02 | .34 | 61 | .06 |
| 21 | .49 | 35 | .04 | .32 | 19 | .02 | .32 | 45 | .04 |
| 22 | .38 | 20 | .02 | .32 | 17 | .01 | .32 | 48 | .04 |
| 23 | .39 | 40 | .04 | .34 | 68 | .06 | .30 | 52 | .04 |
| 24 | .39 | 45 | .05 | .33 | 52 | .05 | .34 | 32 | .03 |
| 25 | .36 | 20 | .02 | .30 | 56 | .04 | .24 | 33 | .02 |
| 26 | .33 | 20 | .02 | .31 | 68 | .04 | .28 | 39 | .03 |
| 27 | .29 | 10 | .01 | .30 | 50 | .04 | .30 | 47 | .04 |
| 28 | .29 | 50 | .04 | .29 | 39 | .03 | .28 | 46 | .03 |
| 29 | .31 | 20 | .02 | .29 | 56 | .04 | .25 | 38 | .02 |
| 30 | .30 | 40 | .03 | .30 | 56 | .04 | .26 | 34 | .02 |
| 31 | .31 | 35 | .03 | .30 | 42 | .03 | --- | --- | --- |
| TOTAL | 12.16 | --- | 1.14 | 9.35 | --- | 1.53 | 512.00 | --- | 290127.4 |
| YEAR | 825.87 | | 290190.09 | | | | | | |

SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) (00061) | SEDI-MENT, SUS-PENDED (MG/L) (80154) | SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY) (80155) | SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331) | SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM (70332) | SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM (70333) | SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM (70334) | SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM (70335) | SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM (70336) |
|---|---|---|---|---|---|---|---|---|---|---|
| FEB | | | | | | | | | | |
| 27... | 1125 | 1.6 | 334 | 1.4 | 87 | -- | -- | -- | -- | -- |
| 27... | 1130 | 1.6 | 326 | 1.4 | 90 | -- | -- | -- | -- | -- |
| MAR | | | | | | | | | | |
| 10... | 1025 | 2.1 | 389 | 2.2 | 81 | -- | -- | -- | -- | -- |
| 10... | 1030 | 2.1 | 391 | 2.2 | 79 | -- | -- | -- | -- | -- |
| 22... | 1645 | 1.9 | 12900 | 66 | 97 | 99 | 99 | 97 | 98 | 98 |
| SEP | | | | | | | | | | |
| 07... | 1140 | 203 | 52100 | 28600 | 95 | -- | -- | -- | -- | -- |



EXHIBIT B

32



09306255 YELLOW CREEK NEAR WHITE RIVER, CO

LOCATION.--Lat 40°10'07", long 108°24'02", in NE¼SW¼ sec.4, T.2 N., R.98 W., Rio Blanco County, Hydrologic Unit 14050006, on left bank 160 ft (49 m) downstream from bridge on State Highway 64, 0.3 mi (0.5 km) upstream from mouth, and 10 mi (16 km) northwest of White River City.

DRAINAGE AREA.--262 mi² (679 km²).

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1972 to current year.

GAGE.--Water-stage recorder. Concrete control since Sept. 18, 1974. Altitude of gage is 5,535 ft (1,687 m), from topographic map.

REMARKS.--Records good except those for winter period, which are fair. Diversions for irrigation of about 300 acres (1.21 km²) above station.

AVERAGE DISCHARGE.--6 years, 1.76 ft³/s (0.050 m³/s), 1,280 acre-ft/yr (1.58 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,800 ft³/s (193 m³/s) Sept. 7, 1978, gage height, 12.97 ft (3.953 m), from contracted opening and flow over road measurement of peak flow; no flow Sept. 7-16, 1978.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of July 25, 1965, reached a discharge of 1,050 ft³/s (29.7 m³/s) by slope-area measurement of peak flow.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,800 ft³/s (193 m³/s) at 1900 Sept. 7, gage height, 12.97 ft (3.953 m), from contracted opening and flow over road measurement of peak flow, only peak above base of 100 ft³/s (2.8 m³/s); no flow Sept. 7-16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978
MEAN VALUES

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .85 | 1.1 | .48 | .75 | 1.2 | 1.6 | 1.5 | 1.3 | .94 | .48 | .31 | .30 |
| 2 | .85 | 1.2 | .50 | .68 | 1.2 | 1.6 | 1.5 | 1.2 | .94 | .50 | .31 | .30 |
| 3 | .88 | 1.2 | .56 | .68 | 1.2 | 1.3 | 1.6 | 1.1 | .94 | .44 | .25 | .31 |
| 4 | .91 | 1.2 | .56 | .70 | 1.2 | 1.8 | 1.5 | 1.2 | .94 | .42 | .25 | .29 |
| 5 | .97 | 1.2 | .54 | .75 | 1.2 | 1.8 | 1.7 | 1.2 | .94 | .42 | .25 | .29 |
| 6 | 1.0 | 1.3 | .52 | .80 | 1.2 | 2.1 | 1.6 | 1.2 | .95 | .42 | .25 | .29 |
| 7 | .94 | 1.3 | .54 | .90 | 1.2 | 2.0 | 1.5 | 1.2 | .96 | .41 | .25 | 500 |
| 8 | .97 | 1.2 | .52 | .90 | 1.3 | 2.0 | 1.4 | 1.2 | .93 | .41 | .25 | 4.5 |
| 9 | .97 | 1.0 | .50 | 1.0 | 1.3 | 2.0 | 1.4 | 1.1 | .92 | .41 | .24 | 1.1 |
| 10 | 1.0 | .90 | .52 | 1.0 | 1.4 | 2.0 | 1.5 | 1.1 | .86 | .42 | .22 | .48 |
| 11 | .97 | .90 | .60 | 1.0 | 1.4 | 1.8 | 1.4 | 1.1 | .84 | .42 | .21 | .00 |
| 12 | .88 | .80 | .60 | 1.1 | 1.3 | 1.9 | 1.4 | 1.0 | .82 | .42 | .22 | .00 |
| 13 | .94 | .80 | .60 | 1.1 | 1.4 | 1.6 | 1.3 | .97 | .74 | .39 | .47 | .00 |
| 14 | .94 | .70 | .60 | 1.1 | 1.4 | 1.4 | 1.4 | .97 | .71 | .39 | .43 | .00 |
| 15 | .94 | .70 | .60 | 1.2 | 1.3 | 1.6 | 1.4 | .94 | .67 | .39 | .39 | .00 |
| 16 | .94 | .62 | .56 | 1.2 | 1.4 | 1.8 | 1.4 | .94 | .65 | .41 | .37 | .00 |
| 17 | .94 | .60 | .60 | 1.3 | 1.4 | 2.0 | 1.4 | 1.1 | .65 | .42 | .32 | .21 |
| 18 | 1.0 | .60 | .54 | 1.4 | 1.8 | 2.0 | 1.2 | 1.1 | .64 | .43 | .32 | .32 |
| 19 | 1.1 | .56 | .46 | 1.4 | 1.5 | 2.0 | 1.3 | .97 | .62 | .41 | .32 | .34 |
| 20 | 1.1 | .54 | .40 | 1.3 | 1.4 | 1.9 | 1.3 | .94 | .62 | .41 | .32 | .34 |
| 21 | 1.1 | .50 | .40 | 1.2 | 1.4 | 1.7 | 1.3 | .94 | .60 | .40 | .32 | .32 |
| 22 | 1.1 | .50 | .40 | 1.0 | 1.5 | 2.0 | 1.4 | .97 | .59 | .38 | .32 | .32 |
| 23 | 1.1 | .50 | .60 | .95 | 1.7 | 1.7 | 1.2 | .94 | .58 | .39 | .34 | .30 |
| 24 | 1.1 | .50 | .66 | .70 | 1.8 | 2.6 | 1.2 | .94 | .55 | .38 | .33 | .34 |
| 25 | 1.1 | .54 | .68 | .65 | 1.6 | 1.9 | 1.2 | .91 | .55 | .36 | .30 | .26 |
| 26 | 1.0 | .54 | .60 | .60 | 1.4 | 1.7 | 1.2 | .91 | .52 | .33 | .31 | .28 |
| 27 | 1.0 | .50 | .64 | .90 | 1.6 | 1.6 | 1.3 | .91 | .48 | .29 | .30 | .30 |
| 28 | 1.0 | .50 | .66 | 1.1 | 1.7 | 1.6 | 1.2 | .91 | .49 | .29 | .29 | .28 |
| 29 | 1.1 | .48 | .72 | 1.1 | --- | 1.4 | 1.3 | .91 | .50 | .31 | .29 | .25 |
| 30 | 1.1 | .50 | .74 | 1.1 | --- | 1.4 | 1.2 | .91 | .50 | .30 | .30 | .26 |
| 31 | 1.1 | --- | .80 | 1.1 | --- | 1.4 | --- | .91 | --- | .31 | .30 | --- |
| TOTAL | 30.89 | 23.48 | 17.70 | 30.86 | 39.4 | 55.2 | 41.2 | 31.99 | 21.64 | 12.16 | 9.35 | 512.00 |
| MEAN | 1.00 | .78 | .57 | 1.00 | 1.41 | 1.78 | 1.37 | 1.03 | .72 | .39 | .30 | 17.1 |
| MAX | 1.1 | 1.3 | .80 | 1.4 | 1.8 | 2.6 | 1.7 | 1.3 | .96 | .50 | .47 | 500 |
| MIN | .85 | .48 | .40 | .65 | 1.2 | 1.3 | 1.2 | .91 | .48 | .29 | .21 | .00 |
| AC-FT | 61 | 47 | 35 | 61 | 78 | 109 | 82 | 63 | 43 | 24 | 19 | 1020 |

CAL YR 1977 TOTAL 409.70 MEAN 1.12 MAX 13 MIN .37 AC-FT 813
WTR YR 1978 TOTAL 825.87 MEAN 2.26 MAX 500 MIN .00 AC-FT 1640

USGS Water Records for Colorado - data for Piceance Basin streams

Measured by water year - October 1 to September 30, designated by calendar year in which it ends.

Discharge (acre feet)

Yellow Creek - near C-a tract.
Piceance Creek - near C-b tract.
Roan Creek - downstream from Logan Wash, Chevron, other projects.
Parachute Creek - Colony located in its headwaters, Union operating just below Colony, with refinery and camp along Parachute Creek.

Piceance Basin (acre feet/water year)

| Stream | | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|
| Yellow Creek | | 925 | 1,640 | 1,030 | 2,070 |
| Piceance Creek | | 10,540 | 12,710 | 27,920 | 29,860 |
| | total | 11,460 | 14,350 | 28,950 | 31,930 |
| Roan Creek | | 8,540 | 35,750 | 56,610 | 94,860 |
| Parachute Creek | | 4,080 | 21,470 | 40,300 | 46,830 |
| | total | 24,080 | 71,570 | 124,860 | 133,620 |

Sediment Discharge (tons/water year, except*)

Yellow Creek

1977 - 989
1978 - 290,790
1979 - 1,478
1980 - 12,495

Piceance Creek

1977 - 4,123
1978 - 22,729
1979 - 60,158
1980 - 56,115

Parachute Creek

1977 - 30,287
1978 - 60,455
1979 - 164,277
1980 - 127,345

Roan Creek *(mg/1)

1977 - 19,695
1978 - 35,750
1979 - 221,216
1980 - 498,179





09093500 PARACHUTE CREEK AT GRAND VALLEY, CO--Continued

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DAY | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) |
|---|---|---|---|---|---|---|---|---|---|
| | | OCTOBER | | | NOVEMBER | | | DECEMBER | |
| 1 | 3.3 | --- | .85 | 9.0 | 26 | .69 | 7.1 | 121 | 2.3 |
| 2 | 3.8 | --- | .55 | 9.0 | 29 | .77 | 6.6 | 218 | 3.7 |
| 3 | 3.2 | 68 | .56 | 9.5 | 30 | .77 | 6.5 | 259 | 4.6 |
| 4 | 3.1 | 86 | .72 | 9.2 | 11 | .27 | 6.5 | 195 | 3.4 |
| 5 | 3.2 | --- | .55 | 8.9 | 16 | .24 | 6.0 | 186 | 3.0 |
| 6 | 3.1 | --- | .30 | 8.6 | 15 | .35 | 5.3 | 354 | 5.1 |
| 7 | 3.4 | --- | .35 | 8.4 | 22 | .50 | 4.5 | --- | 9.0 |
| 8 | 4.1 | --- | .35 | 8.5 | 16 | .37 | 4.2 | 680 | 7.7 |
| 9 | 3.9 | --- | .40 | 8.8 | 15 | .30 | 4.2 | 210 | 2.4 |
| 10 | 4.0 | --- | .50 | 9.5 | 20 | .51 | 4.3 | 152 | 1.8 |
| 11 | 3.9 | --- | .40 | 10 | --- | 59 | 4.4 | 181 | 2.2 |
| 12 | 3.9 | 34 | .36 | 9.2 | 14000 | 363 | 4.7 | 720 | 9.1 |
| 13 | 4.0 | 20 | .36 | 8.4 | 2000 | 45 | 5.0 | 2180 | 28 |
| 14 | 4.6 | 33 | .41 | 8.8 | 183 | 4.0 | 5.2 | --- | 50 |
| 15 | 4.7 | 30 | .40 | 8.4 | 130 | 3.1 | 5.4 | --- | 73 |
| 16 | 5.1 | 30 | .41 | 8.8 | 110 | 2.5 | 5.7 | 4180 | 64 |
| 17 | 5.0 | 23 | .31 | 7.6 | 95 | 1.9 | 6.3 | 1610 | 27 |
| 18 | 4.8 | 49 | .64 | 7.6 | 91 | 1.9 | 7.2 | --- | 8.9 |
| 19 | 5.0 | 44 | .59 | 7.8 | 89 | 1.9 | 8.1 | --- | 6.6 |
| 20 | 5.7 | 51 | .78 | 7.0 | 84 | 1.8 | 7.6 | --- | 6.0 |
| 21 | 6.3 | 30 | .51 | 7.0 | 250 | 5.3 | 7.8 | --- | 6.3 |
| 22 | 6.1 | 25 | .41 | 7.5 | 409 | 8.3 | 8.2 | --- | 6.6 |
| 23 | 9.0 | 21 | .51 | 7.2 | --- | 5.6 | 8.0 | --- | 6.5 |
| 24 | 12 | 21 | .68 | 7.0 | 167 | 3.2 | 6.9 | --- | 5.6 |
| 25 | 12 | 21 | .68 | 7.8 | 81 | 1.6 | 6.7 | 306 | 5.5 |
| 26 | 12 | 43 | 1.4 | 6.9 | 68 | 1.3 | 6.6 | 142 | 2.6 |
| 27 | 11 | 44 | 1.3 | 6.6 | 69 | 1.2 | 7.6 | 488 | 10 |
| 28 | 11 | 31 | .92 | 6.7 | 90 | 1.0 | 8.5 | 878 | 20 |
| 29 | 11 | 27 | .80 | 6.0 | 201 | 3.7 | 9.4 | 610 | 15 |
| 30 | 10 | 24 | .65 | 7.1 | 230 | 4.4 | 9.9 | --- | 14 |
| 31 | 10 | 16 | .42 | --- | --- | --- | 9.0 | 476 | 13 |
| TOTAL | 192.4 | --- | 18.30 | 244.7 | --- | 525.23 | 204.8 | --- | 422.8 |

| DAY | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) |
|---|---|---|---|---|---|---|---|---|---|
| | | JANUARY | | | FEBRUARY | | | MARCH | |
| 1 | 8.5 | 398 | 9.3 | 8.6 | 182 | 4.2 | 11 | 310 | 9.2 |
| 2 | 8.6 | 236 | 5.5 | 8.0 | 188 | 4.5 | 10 | 320 | 8.6 |
| 3 | 9.0 | 208 | 4.9 | 8.5 | --- | 3.5 | 9.4 | 418 | 10 |
| 4 | 9.6 | 320 | 8.3 | 7.8 | --- | 1.0 | 8.8 | 1870 | 44 |
| 5 | 10 | 426 | 11 | 7.6 | 27 | .55 | 8.8 | 2640 | 63 |
| 6 | 11 | 330 | 9.8 | 7.6 | 23 | .47 | 9.0 | 3280 | 85 |
| 7 | 11 | 130 | 3.9 | 7.4 | 24 | .49 | 11 | 10700 | 319 |
| 8 | 10 | --- | 4.0 | 7.8 | 23 | .48 | 12 | 28300 | 917 |
| 9 | 10 | 124 | 3.3 | 8.2 | --- | .44 | 12 | --- | 470 |
| 10 | 10 | 76 | 2.0 | 8.6 | 22 | .51 | 18 | 4880 | 150 |
| 11 | 11 | 53 | 1.6 | 9.2 | --- | .88 | 12 | 3250 | 105 |
| 12 | 12 | 85 | 1.0 | 9.7 | --- | 1.3 | 13 | 5800 | 206 |
| 13 | 12 | 117 | 3.8 | 10 | --- | 1.9 | 14 | 6600 | 249 |
| 14 | 11 | 78 | 2.3 | 10 | --- | 2.6 | 15 | 6300 | 250 |
| 15 | 11 | 92 | 2.7 | 9.0 | 157 | 4.2 | 16 | 6240 | 270 |
| 16 | 12 | 87 | 2.8 | 9.6 | 285 | 7.2 | 15 | --- | 230 |
| 17 | 12 | 90 | 2.9 | 9.0 | 153 | 3.7 | 14 | --- | 160 |
| 18 | 12 | 97 | 3.1 | 9.0 | 66 | 1.6 | 14 | --- | 130 |
| 19 | 12 | 95 | 3.1 | 9.0 | 115 | 2.8 | 15 | 2000 | 81 |
| 20 | 11 | 114 | 3.4 | 9.3 | 178 | 4.5 | 17 | 2360 | 108 |
| 21 | 10 | --- | 3.5 | 9.3 | 183 | 4.6 | 17 | 1800 | 83 |
| 22 | 9.6 | --- | 3.0 | 9.2 | 261 | 6.5 | 14 | 4200 | 159 |
| 23 | 9.2 | 161 | 4.0 | 9.0 | 302 | 7.3 | 14 | 1200 | 46 |
| 24 | 9.4 | --- | 4.7 | 9.1 | 730 | 18 | 14 | 2660 | 100 |
| 25 | 9.4 | 164 | 4.2 | 9.9 | 1270 | 34 | 14 | 2100 | 79 |
| 26 | 9.1 | 194 | 3.0 | 10 | 580 | 16 | 15 | 2100 | 85 |
| 27 | 8.4 | 184 | 4.3 | 11 | 400 | 12 | 16 | 27000 | 1170 |
| 28 | 8.5 | 102 | 4.4 | 11 | 330 | 9.0 | 18 | 24000 | 1170 |
| 29 | 8.4 | 183 | 4.2 | --- | --- | --- | 20 | 6600 | 356 |
| 30 | 7.0 | --- | 3.9 | --- | --- | --- | 20 | 3320 | 179 |
| 31 | 6.8 | --- | 6.0 | --- | --- | --- | 21 | 4100 | 232 |
| TOTAL | 312.3 | --- | 134.4 | 254.2 | --- | 154.94 | 437.8 | --- | 7557.8 |

?

EXHIBIT E

32

PARACHUTE CREEK BASIN

203

09093500 PARACHUTE CREEK AT PARACHUTE, CO--Continued

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

| DAY | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) |
|---|---|---|---|---|---|---|---|---|---|
| | | OCTOBER | | | NOVEMBER | | | DECEMBER | |
| 1 | 6.0 | 16 | .18 | 19 | 26 | .98 | 13 | 46 | 1.6 |
| 2 | 6.0 | 6 | .08 | 16 | 30 | 1.1 | 13 | 20 | .70 |
| 3 | 6.6 | 7 | .08 | 13 | 21 | .79 | 14 | 22 | .93 |
| 4 | 3.6 | 8 | .07 | 13 | 29 | 1.0 | 14 | 27 | 1.0 |
| 5 | 4.1 | 12 | .13 | 13 | 30 | 1.2 | 14 | 30 | 1.1 |
| 6 | 4.6 | 12 | .14 | 13 | 21 | .74 | 14 | 32 | 1.2 |
| 7 | 4.4 | 11 | .13 | 13 | 33 | 1.2 | 13 | 27 | .95 |
| 8 | 4.6 | 11 | .14 | 14 | 137 | 9.2 | 13 | 18 | .63 |
| 9 | 4.8 | 19 | .23 | 14 | 45 | 1.7 | 13 | 18 | .63 |
| 10 | 5.0 | 17 | .23 | 13 | 20 | .70 | 13 | 17 | .60 |
| 11 | 5.3 | 13 | .19 | 13 | 19 | .67 | 13 | 17 | .60 |
| 12 | 5.5 | 45 | .67 | 12 | 25 | .83 | 13 | 46 | 1.6 |
| 13 | 5.7 | 21 | .32 | 12 | 15 | .49 | 13 | 23 | .81 |
| 14 | 6.0 | 32 | .52 | 12 | 17 | .55 | 13 | 15 | .53 |
| 15 | 6.0 | 9 | .19 | 12 | 10 | .30 | 13 | 26 | .91 |
| 16 | 6.7 | 9 | .16 | 16 | 15 | .60 | 13 | 26 | .91 |
| 17 | 7.6 | 13 | .27 | 16 | 16 | .60 | 13 | 25 | .88 |
| 18 | 8.4 | 73 | 1.6 | 16 | 26 | .98 | 13 | 32 | 1.1 |
| 19 | 9.0 | 89 | 2.2 | 16 | 19 | .72 | 14 | 29 | 1.1 |
| 20 | 13 | 9070 | 468 | 16 | 9 | .39 | 14 | 25 | .94 |
| 21 | 12 | 236 | 7.3 | 15 | 20 | .81 | 15 | 29 | 1.2 |
| 22 | 13 | 118 | 4.1 | 15 | 18 | .73 | 15 | 34 | 1.4 |
| 23 | 13 | 122 | 4.3 | 15 | 21 | .85 | 15 | 29 | 1.2 |
| 24 | 13 | 260 | 9.1 | 15 | 24 | .97 | 15 | 28 | 1.1 |
| 25 | 13 | 206 | 7.2 | 15 | 27 | 1.1 | 15 | 16 | .73 |
| 26 | 13 | 47 | 1.6 | 15 | 21 | .85 | 15 | 23 | .93 |
| 27 | 13 | 36 | 1.3 | 15 | 38 | 1.5 | 15 | 21 | .85 |
| 28 | 13 | 42 | 1.5 | 15 | 37 | 1.5 | 15 | 37 | 1.5 |
| 29 | 13 | 33 | 1.2 | 15 | 67 | 2.7 | 15 | 29 | 1.2 |
| 30 | 13 | 38 | 1.3 | 14 | 67 | 2.5 | 15 | 22 | .89 |
| 31 | 14 | 52 | 2.0 | --- | --- | --- | 15 | 22 | .69 |

| DAY | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) | MEAN DISCHARGE (CFS) | MEAN CONCEN-TRATION (MG/L) | SEDIMENT DISCHARGE (TONS/DAY) |
|---|---|---|---|---|---|---|---|---|---|
| | | JANUARY | | | FEBRUARY | | | MARCH | |
| 1 | 15 | 16 | .65 | 13 | 413 | 6.0 | 18 | 190 | 8.8 |
| 2 | 15 | 16 | .65 | 13 | 78 | 2.7 | 18 | 155 | 7.5 |
| 3 | 14 | 19 | .72 | 13 | 41 | 1.4 | 18 | 175 | 8.5 |
| 4 | 14 | 19 | .72 | 12 | 1620 | 57 | 19 | 210 | 11 |
| 5 | 14 | 14 | .53 | 13 | 177 | 6.2 | 19 | 140 | 6.2 |
| 6 | 14 | 14 | .53 | 13 | 75 | 2.6 | 19 | 1080 | 72 |
| 7 | 14 | 10 | .38 | 16 | 52 | 2.0 | 21 | 1510 | 102 |
| 8 | 14 | 10 | .38 | 14 | 79 | 3.0 | 19 | 395 | 20 |
| 9 | 14 | 13 | .49 | 16 | --- | 3.0 | 18 | 262 | 13 |
| 10 | 29 | 10100 | 1260 | 14 | 71 | 2.7 | 18 | 225 | 11 |
| 11 | 15 | 200 | 8.1 | 14 | 31 | 1.2 | 18 | 205 | 10 |
| 12 | 14 | 150 | 5.7 | 13 | 37 | 1.3 | 18 | 275 | 13 |
| 13 | 20 | 734 | 51 | 13 | 77 | 2.7 | 18 | 185 | 9.0 |
| 14 | 35 | 4720 | 710 | 32 | 15800 | 2970 | 18 | 154 | 7.5 |
| 15 | 16 | 239 | 10 | 50 | 20500 | 4600 | 18 | 162 | 7.9 |
| 16 | 14 | 118 | 4.5 | 21 | 2250 | 143 | 18 | 160 | 7.8 |
| 17 | 14 | 83 | 3.1 | 17 | 175 | 8.0 | 17 | 136 | 6.2 |
| 18 | 14 | 41 | 1.6 | 39 | 19500 | 1720 | 18 | 239 | 12 |
| 19 | 14 | 31 | 1.2 | 26 | 2920 | 248 | 18 | 163 | 7.9 |
| 20 | 14 | 19 | .72 | 30 | 8680 | 1260 | 17 | 170 | 7.8 |
| 21 | 14 | 36 | 1.4 | 20 | 994 | 64 | 18 | 172 | 8.4 |
| 22 | 14 | 36 | 1.4 | 22 | 3540 | 263 | 18 | 205 | 10 |
| 23 | 14 | 37 | 1.4 | 21 | 5100 | 423 | 18 | 165 | 9.0 |
| 24 | 14 | 59 | 2.2 | 18 | 430 | 21 | 18 | 141 | 6.8 |
| 25 | 13 | 36 | 1.3 | 18 | 300 | 15 | 19 | 299 | 15 |
| 26 | 13 | 27 | .95 | 17 | 240 | 11 | 19 | 200 | 10 |
| 27 | 13 | 31 | 1.1 | 18 | 230 | 11 | 19 | 265 | 14 |
| 28 | 13 | 32 | 1.1 | 18 | 270 | 13 | 19 | 200 | 10 |
| 29 | 14 | 35 | 1.3 | 18 | 215 | 10 | 19 | 148 | 7.6 |
| 30 | 14 | 153 | 5.8 | --- | --- | --- | 19 | 145 | 7.4 |
| 31 | 14 | 177 | 6.7 | --- | --- | --- | 19 | 283 | 14 |

33

LWV
C

The League of Women Voters of Colorado
1600 Race Street
Denver, CO. 80206
303 – 320-8493

August 24, 1982

COMMENTS
of
THE LEAGUE OF WOMEN VOTERS OF COLORADO
on
THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
for the
PROTOTYPE OIL SHALE LEASING PROGRAM
August 24, 1982

I am Hester McNulty speaking for the League of Women Voters of Colorado. Some of our 23 local Leagues are in the region which would be affected by additional prototype leases and they will address their specific local concerns at the Grand Junction meeting.

First the League compliments you for the preparation of a good Environmental Impact Statement (EIS). It is readable, concise, delineates the major issues and analyzes alternatives. We also think, in most cases, the probable impacts are assessed correctly within the limits of existing data.

We have found, however, that there is more recent information on the quality of raw shale lechates than was used in the preparation of the EIS. Laboratory studies have indicated that particular emphasis should be placed on aluminum, boron, flouride and zinc as well as molybedenum in Mahogany mined shales. This study also recommended that sulfur species in the lechate should be determined (Bates, Wolf and McWhorter 1981). We believe the EIS should more adequately address the runoff and lechate from raw shale piles. (113)

The League's preference is for the No Action Alternative. We have chosen this alternative because the EIS indicates that even without additional prototype leases the region could be subject to serious air quality problems and in some cases violate health standards. Moreover, air quality in wilderness and recreation areas would be threatened. Leasing should be postponed until technology either eliminates or substantially reduces emissions from oil shale projects.

33

UMV/C - 8/24/82 2

However, if the decision is made to lease, it should be consistent with the original goals of the Prototype Oil Shale Leasing Program which were to test the technical, economic and environmental feasability of differing oil shale technologies. Production should be limited to 10,000 Barrels per Day (BPD) until the technology is proven, the economic feasability is established and the environmental data is analyzed. Because both tracts would demonstrate the same multi-mineral technology leasing should be limited to one tract.

After eight years of the Prototype Program no technologies have yet been tested. This fact and recent events on private lands should indicate that for the Prototype Program to fulfill its original purpose, a 10,000 BPD limit is desireable. New technology for emissions control could also be developed so that if a larger operation proved to be feasable, the impact on air quality would be reduced or eliminated.

If the decision is made to lease, Tract C-18 was judged to have less severe impacts than Tract C-11 and is therefore preferable. And, if a lease is granted, the environmental stipulations should clarify that state environmental regulations and standards which are more stringent than either federal regulations or law will be complied with. We believe this is necessary because EPA is in the process of issuing weak regulations for environmental programs and there is a possibility that new federal legislation will not protect Colorado's resources - the question of primacy could arise. (78)

We also think the state should be a party to those decisions in the environmental stipulations which are left to the discretion of the Mining Supervisor. Examples are additional air, surface water and groundwater monitoring requirements, the use of pesticides and clean up of hazardous or oil spills. (114)

Finally if the lease is to prove the feasibility of multi-mineral processing then the lease must require the processing and economic recovery of nacholite and dawsonite. This stipulation must be added or any reason for the lease will be invalidated. (27)

34

Dear Sir: 12 Aug 1982

I have reviewed the draft Supplemental EIS for the Prototype Oil Shale Leasing Program. A major flaw is its faliure to adequately address mitigation required by Executive Order 11988, Protection of Floodplains. The draftEIS does discuss the fact that floodplains could be impacted, but does not describe mitigative measures that would be necessary should the action take place. Altho site-specific development plans may be lacking at this time, Chapter IV's paragraphs on floodplains do not even address floodplains! Ag lands and alluvial valleys (not floodplains) are mentioned. (115)

My master's thesis concerned the impacts of oil shale development on the national park system in the Upper Colorado River Basin. Please edit the DEIS to remove the frequently-occurring and redundant "immediately adjacent" and "in close proximity". Terrible grammar! (Something is either next to something, or it isn't!)

Please put me on the mailing list for subsequent documents and make this a part of the official record.

Thank You.

David Schein

512 Na-Wa-Ta, Mt. Prospect, IL 60056

**35**

United States Department of the Interior

BUREAU OF RECLAMATION
UPPER COLORADO REGIONAL OFFICE
P.O. BOX 11568
SALT LAKE CITY, UTAH 84147

'82 SEP 13 AM

IN REPLY REFER TO: UC-150
120.2

Memorandum

To: State Director, Bureau of Land Management, Colorado State Office, 1037 20th Street, Denver, Colorado 80202

From: Regional Director
Bureau of Reclamation

Subject: Review of Draft Environmental Statement for the Prototype Oil Shale (DES No. 82-44)

We have reviewed the above draft environmental statement and offer the following comments for your consideration:

1. The stated need for leasing one or two additional oil shale tracts in Colorado is to test new technologies, such as true in situ processing and mining associated minerals concurrently with oil shale. Is there any requirement or incentive that these technologies will be utilized on the new tracts? (27)

2. Flow changes in Yellow and Piceance Creeks as well as the White River are mentioned in general terms. Pre- and post-project monthly flow estimates would provide better information for impact analysis. (116)

3. The statement discusses increases in surface water total dissolved solids, but does not provide estimates of how this water quality parameter would change in the Colorado River system. This is of particular interest to water users in the Lower Colorado River Basin. (2)

4. On page 137, the report indicates that reductions in flow of the White River would be lost for other uses, such as agriculture. Is this meant to mean potential or actual agricultural uses? If appropriate, protection of existing agricultural water uses should be discussed. (117)

We appreciate the opportunity to review this draft environmental statement.

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**36**

PIONEERS HOSPITAL
OF RIO BLANCO COUNTY
345 CLEVELAND
MEEKER, COLORADO 81641
(303) 878-5047

JOHN M OSSE
Administrator

DIRECTORS
STEVEN D HARP
President
LYNN K WHITEMAN
Vice President
ANN KLINGLESMITH
Secretary
EMMA LOU FRISBY
BEVERLY SHAW
SAM T LOVE
ROBERT H CRAWFORD

September 16, 1982

Mr. John Singlaub
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, Colorado 81641

RE: Prototype Oil Shale Draft EIS

Dear Mr. Singlaub,

Thank you for the opportunity to comment on the enviromental impact statement (EIS) regarding the Prototype Oil Shale Leasing Program held at the Fairfield Center in Meeker on the evening of August 25th. After listening to the testimony that evening and reviewing the EIS, I find no mention of potential impact on the medical/hospital services in the Meeker catchment area, as a result I would like to address this aspect of potential impact. (118)

Pioneers Hospital is a county supported hospital licensed for 17 beds with an attached 25 bed skilled nursing home which is operated by the hospital. Of the 17 hospital beds, 11 are general medical/surgical, four are obstetric and two are intensive/cardiac care beds. We are a full service hospital providing services regarding general medicine, surgery, obstetrics, nursery, physical therapy, respiratory therapy, pharmacy, emergency room, laboratory, X-Ray, dietary, intensive & cardiac care, ambulance service, etc. The average hospital occupancy rate in 1981 was approximately 30-35%. This percentage has decreased in 1982 to approximately 20-25% due primarily to the significant cut back in energy development with resulting financial short falls for the hospital. Due to the number of beds however, the average percentage rates may be misleading, e.g., there are days when our patient census may be 90% plus while other days it may be 10% or less. The number of patients in the hospital tends to be higher on Wednesdays and Thursdays as routine surgeries are scheduled for

Mr. John Singlaub, BLM
Sept. 16, 1982
Page 2.

Thursday mornings.

Due to the size of the hospital, the opening of one or two additional oil shale leasing sites and the resulting population, could significantly impact the hospital and current medical staff which is comprised of two physicans, one in general practice and the other in family practice. Any significant increase in activity regarding the current energy sites, i.e., C-a, C-b, Multi-Mineral and Northern Coal could also significantly add to the impact on the medical care system in Meeker. Such impacts could easily require the expansion of the current facility or the construction of a new hospital and the need to recruit additional physicans, nurses and other hospital personnel.

The hospital is currently in the process of developing a planning document with the assistance of consultants, which will address some of these questions and issues. The hospital is also currently involved in addressing the special medical needs which will occur relating to aspects of industrial medicine which will, hopefully, be of benefit to the energy industry, their employees and families, hospital and community-at-large.

I hope this information is helpful. Please contact me regarding any questions, additional information or need for clarification.

Sincerely,

John M. Osse

John M. Osse
Administrator

cc: Director of Development
Rio Blanco County



# NATIONAL WILDLIFE FEDERATION

NATURAL RESOURCE CLINIC
FLEMING LAW BUILDING
BOULDER, COLORADO 80309
303/492-6552

ROBERT J. GOLTEN
COUNSEL

FRANCES M. GREEN
COUNSEL

21 September 1982

Mr. John Singlaub
Oil Shale Projects
Team Leader
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, CO 81641

Dear John:

The National Wildlife Federation has reviewed the Draft Environmental Impact Statement ["DEIS"] for the prototype oil shale leasing program and would like to compliment you and your team on a document that, in general, is much better than the average DEIS. We appreciate the effort you put into the DEIS preparation and recognize that you produced it under some significant time constraints. We do, however, have a number of serious criticisms of the terms of the proposed Oil Shale Lease and Environmental Stipulations, which we set forth below. In addition to these comments, we also adopt and incorporate by reference the comments filed on the DEIS by Friends of the Earth and the Environmental Defense Fund.

The National Wildlife Federation ["NWF"] has over 4.6 million members and supporters, 20,000 of whom live in Colorado. Environmental impacts resulting from resource developments are a principal concern of NWF. We believe that the protection of the environment is best achieved through reasoned and judicious resource development decisions and that certain areas, due to their environmental quality and natural beauty, are best protected by excluding all development. In this light, the impacts from oil shale leasing and development represent a central issue for our national membership, including our Colorado members, many of whom view oil shale development in the Piceance Basin as certain to degrade or eliminate a significant wildlife resource.

Perhaps our most serious concern is with the possibility that tract C-11 might be leased. The entire tract is critical winter range for mule deer. Moreover, the tract splits in half a larger critical winter range area, leaving only two smaller and unconnected areas in which deer can safely winter in the Basin. It is our view that C-11 should not be leased. (2)

**37**

Mr. John Singlaub
Page 2
21 September 1982

We also think the terms of the proposed lease are grossly inadequate. First, the lease does not ensure a fair return to the public for its valuable shale oil resources or encourage phased and planned development of the resource to meet the nation's energy needs. In fact, the lease encourages exactly the opposite--speculation in oil shale properties. Second, the provisions of the lease are not strict enough to adequately protect environmental values and, in this regard, do not reflect the conclusions of other sections of the DEIS.

<u>General Provisions</u>

Under Section 5 of the lease, the bonus payment for the lease is payable in five installments, the first being due at the time of sale, the last four being equal installments due each year on the anniversary date of the lease. The lessee, however, is allowed to credit against the fourth and fifth bonus installments any expenditures made by it directly attributable to operations for the development of the leased deposits. While this provision will surely encourage expenditures for development early in the lease term, it does so at the cost of millions of dollars to the public. Moreover, it is unnecessary, since the same result could be achieved by simply requiring development within a reasonable period of time. The "diligence requirements" in Section 10 of the lease, however, do not do so. They require only that a development plan be submitted by the lessee within three years of the lease date. (106) Even then, the failure to submit an acceptable plan does not mean the lease will be terminated. It is only grounds for termination "if the Lessor so elects." The only provision requiring actual development is contained in Section 4 which sets the term of the lease at 20 years "and so long thereafter as there is production from the Leased Deposits in commercial quantities." A lessee thus can hold a lease for 20 years by, at most, only submitting a mine plan. In our view, oil shale leases, like coal leases, should terminate after 10 years unless they are producing in commercial quantities, and there should be a requirement for diligent development and continued operation. In addition, a lease should automatically terminate if a development plan is not submitted within 3 years, or an "acceptable" plan within a reasonable time thereafter.

The royalty payments set forth under Section 7 are much too low. They are based on cents per ton for oil shale, rather than a percent of the value of the shale. [This is in contrast to the treatment of other minerals, for which a percentage royalty is required.] This does not protect the public from inflation or allow the public to benefit from increases in the value of oil shale. In 1976, Congress amended the Mineral Leasing Act of 1920 to require a minimum 12-1/2% royalty for federal coal. The (119) principal concern expressed by Congress was that the cents per ton royalty rate established by the previous law had not resulted in a fair return to the public but, instead, in royalties that decreased, over time, as a percentage of the value of the coal. The same

**37**

Mr. John Singlaub
Page 3
21 September 1982

reasoning applies to oil shale. Royalties should be established as a percentage of the value of the oil produced.

The royalties section of the lease is defective in at least two other respects. Although minimum royalty payments are required from the sixth year on, regardless of whether any oil is being produced, the lease does not specify the annual production rate to be assumed for purposes of calculating this minimum royalty. Whether the minimum royalty is reasonable, and whether it will (65) have any real effect on encouraging development, obviously depends on the annual production rate assumed. That rate should be the same for each lease, should be reasonable, and should be established in advance of leasing.

The royalty provision in the lease also allows for crediting royalty payments in the sixth through tenth years against any expenditures made directly attributable to development of the deposits pursuant to the development plan. We think this provision (106) is unwise and unnecessary for the same reasons we objected to a similar provision with respect to bonus payments, as set forth above.

When low royalty payments are combined with the lack of diligence requirements, the result is an increase in speculation and a woefully inadequate return to the public for its land and resources. These are precisely the concerns that led Congress to amend the Mineral Leasing Act of 1920 with respect to federal coal leasing. The Department has the authority to impose more stringent requirements in oil shale leases, and should do so.

<u>Environmental Stipulations</u>

The environmental stipulations contained in the lease are inadequate in a number of respects. The principal problem--and one that pervades the stipulations--is the inordinate amount of discretion placed in the hands of the Mining Supervisor to approve and establish various environmental requirements, coupled with the absence of any specific standards to provide guidance. For example, the Mining Supervisor is responsible for approving the lessee's comprehensive environmental monitoring program and terminating it where it is in the "public interest." This includes, among other things, deciding how often, where, and what constituents should be monitored to track surface water quality; how many observation wells are needed to test ground water; where air quality monitoring stations should be located; and how far downstream aquatic habitat should be studied. The Mining Supervisor has final authority to approve the lessee's vegetation plan and mitigation measures for areas disturbed during exploration; approve mitigation of damage to fish and wildlife habitat not foreseen in the development plan; specify how a cultural resource

Mr. John Singlaub
Page 4
21 September 1982

field inventory is to be taken; determine whether a paleontological appraisal is necessary; determine whether any aquifer is a potentially valuable water supply; approve an erosion control and surface rehabilitation plan; approve a revegetation plan, including species, density and timing; and determine whether the lessee has demonstrated that the required revegetation technology is available. While the Mining Supervisor now has available to him/her a multidisciplinary team at the oil shale office upon which s/he can rely, all of the decisions referred to above (and any others of any significance) should actually be made collectively by this interdisciplinary team and not by the Mining Supervisor. Since MMS's team currently lacks expertise in some disciplines, these decisions should also be made only after consultation with the relevant state agency and only with the concurrence of the Bureau of Land Management ["BLM"], which has considerable environmental expertise. BLM, after all, is ultimately responsible for the surface land under lease. Yet, the proposed lease provides for BLM concurrence with respect to only one decision--the revegetation program. BLM should be directly and substantially involved in all significant decisions made under the lease that affect the environment. It is especially important that decisions at the mining stage be made only after thorough environmental analysis, since no EIS will be prepared at that stage. (114)

Following are more specific criticisms of some provisions of the lease. Under Section 10 of the general provisions, any exploratory work performed by the lessee on leased lands, prior to submission or approval of the detailed development plan, requires only approval of the Mining Supervisor. Given the potential for environmental degradation associated with exploratory work (drilling, blasting, cross-country travel, road construction), a public review and comment period should be mandatory prior to approval of the exploratory work, just as it is for the detailed development plan. (22)

An environmental monitoring program submitted as part of an exploratory work plan (Section 1.(C) of the Environmental Stipulations) may not adequately reflect undisturbed conditions due to the ongoing exploratory work. A monitoring program should begin sufficiently in advance of actual exploratory work to ensure real baseline data. Also, collection of data for one year prior to development may not provide the "true" baseline condition. This should be taken into account, since an accurate environmental baseline is an important prerequisite to a successful reclamation program. (120)

Permitting the Mining Supervisor to terminate the environmental monitoring program when s/he is satisfied that environmental conditions are reestablished following the completion of



Mr. John Singlaub
Page 5
21 September 1982

mining, or earlier if the Mining Supervisor deems it to be in the public interest [Section 1.(C)], implies that reclamation of oil shale wastes has succeeded on a commercial scale (which is untrue) and ignores the fact that certain tree species require more than 100 years to reestablish. The lease fails to mention who is responsible for correcting ensuing environmental problems (e.g., erosion, non-establishment of species, maintenance of plantations) in the interim between cessation of mining and the reestablishment of pre-existing environmental conditions. (121)

Section 11(A), on rehabilitation, provides that all affected lands shall be restored "to a usable or productive condition consistent with or equal to pre-existing land uses in the area and compatible with existing adjacent undisturbed natural areas." The inclusion of the words "consistent with" creates an ambiguity as to the meaning of this standard. Is "consistent with" different from "equal to?" The potential confusion is compounded by the fact that the last sentence in subsection (A) repeats the test, but with the words "consistent with" omitted. (122)

Perhaps the most egregious omissions in the environmental stipulations occur in Section 14 on Waste Disposal. The application of adequate environmental mitigation techniques to spent shale in commercial scale operations is in its infancy. The DEIS acknowledges that the "methodology for revegetating spent shale piles on a large scale basis is in the speculative phase" (p. 149). Yet, not a hint of this is reflected in Section 14. Section 14 implies that spent shale piles can be designed to ensure stability and can be revegetated. Yet, no one is sure this can be done or, if it can, what techniques are best. The Section instructs the lessee to select and prepare disposal sites for wastes so as to avoid downward percolation of leached products and other pollutants into aquifers. Once again, the present state of the art is such that no one knows whether and how ground water can be protected from contamination from spent shale leachates. This is also true with respect to surface water, for which Section 14 provides no protection. (18)

A fundamental underlying assumption of Section 14 appears to be that somehow reclamation methodologies will fortuitously appear to accomplish the goal of protecting and reestablishing the environment. But this is simply an insufficient basis on which to proceed with a massive oil shale project with potentially devastating effects from waste products. We think that Section 14 must contain provisions modeled after those in Section 11(L)(3) on rehabilitation which requires that the lessee demonstrate at the time of submission of a development plan that technology is available to provide revegetation and, if the lessee cannot show the availability of required technology that s/he submit a program designed to obtain the required technology. If the lessee has

Mr. John Singlaub
Page 6
21 September 1982

not demonstrated the necessary technology by the tenth year of the lease, operations must cease until the technology is available. We think these principles must be applied not only to revegetation of mine waste, but to slope stability, erosion, and contamination of surface and ground water from spent shale leachates. If the lessee cannot demonstrate that the required technology is available, and works, then development must cease. The potential for significant and perhaps irreparable harm is too great for any less stringent requirements.

We also take exception to another assumption apparently underlying the DEIS--that the government is eventually going to be responsible for waste disposal. The DEIS states on p. 189 that "[u]pon decommissioning of mine facilities, monitoring and maintenance of waste disposal piles may become the responsibility of the federal government should the company refuse to continue monitoring the maintenance activities due to the expense." The government should never have to be financially responsible for the waste disposal piles. The lease should expressly require the lessee to assume responsibility for waste disposal piles after decommissioning and until monitoring and maintenance is no longer necessary. A substantial bond should be required to ensure that if the lessee ignores its responsibilities, it will not be at the public's expense. (121)

Conclusion

Unfortunately, the Department of Interior's rush to lease land for oil shale mining has minimized reasoned debate regarding how best to proceed in reviewing oil shale development proposals and evaluating strategies for dealing with long-term environmental impacts. Given the magnitude of the environmental consequences contemplated for oil shale development in the Piceance Basin and the uncertainty of its impacts, we recommend the following actions. First, certain changes should be made in the Oil Shale Environmental Advisory Panel to help it function more effectively. Environmental interest groups should be represented on the Panel. They are not now, which, in our view, is a serious oversight. The Panel should also elect its own chairperson and hire its own staff. And, the Panel should undertake responsibility for reviewing research design and environmental monitoring programs and advising lessees on research procedures and results. Many state and federal permitting agencies have need of current environmental research information as well as a forum for factoring their data needs into the research process.

Second, in conjunction with the oil shale Advisory Panel, and to foster the widest dissemination of information to the broadest spectrum of Colorado citizens, we recommend that the (123)





Mr. John Singlaub
Page 7
21 September 1982

lessees be required to present an annual report to the citizens of Colorado at a series of public meetings hosted by the Department of Interior. We expect that a citizens' advisory committee and an annual report to the citizens of Colorado will help to supply some of the missing links in the oil shale development dialogue.

We appreciate the opportunity to comment on the DEIS for the prototype Oil Shale Leasing Program, and we look forward to your response to the issues presented in this letter.

Sincerely,

Frances M. Green

Frances M. Green
Counsel

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38

# FRIENDS OF THE EARTH

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22 September 1982
Hand Delivered

Mr. John Singlaub
Oil Shale Team Leader
Bureau of Land management
P.O. Box 928
Meeker, Colorado 81641

Dear John:

Attached please find Friends of the Earth's detailed comments on the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program. The Bureau and your team have done a creditable job in preparing the EIS. It is not without problems, but far surpasses the documents we have come to expect in past years.

Many of the deficiencies of the environmental statement and the proposed program arise from the haste with which the Bureau has wished to implement new oil shale leasing. Originally DOI proposed to commence planning for new prototype leasing in August of 1980, ending with a lease sale in August of 1983. Preparation of this program commenced early in this year with scoping and tract nominations. Leasing is now planned in January, 1983 -- a one rather than a three year schedule.

Suffering the most from this compressed schedule is land use planning. Basing the proposed action on the existing Management Framework Plan has unduely constrained the choice of alternative actions. Several other deficiencies affect the viability of the proposed action:

o Despite the intent to lease to test multi-mineral oil shale extraction technologies, the lease does not in fact require full recovery of all resources which will ensure multi-mineral extraction. (27)

o The mitigation measures proposed for socio-economic impacts are woefully inadequate despite the seriousness of the effects predicted by the environmental statement. (124)

o Environmental mitigation measures also do not measure up to the impacts which are necessary to avoid or minimize.

o The maturity of the technologies proposed for first-of-a-kind commercial development here is not demonstrated. This will probably lead to another failure for the Prototype Program. One (19)

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38

sign of the lack of maturity of the technologies is the low resource recovery which is anticipated.

o The economy does not favor shale development presently. Leasing will probably attract inadequate lease bonus revenue -- a problem for the oil shale region's communities as well as the nation's taxpayers. Leasing at this time will only raise false hopes in Western Colorado without any substantive improvements in the industry or the economy there. (16)

o As mentioned above, the proposed action falls within the scope of the existing, obsolete Management Framework Plan (with possible exceptions which we note in our detailed comments). This unduely restricts BLM's choices among potential locations for multi-mineral experimentation. Neither proposed lease tract may be the best for the proposed action based on true multiple use criteria. (125)

o Finally, the environmental statement reveals serious environmental and social consequences of the proposed action. These alone should probably be fatal to the action as currently proposed.

As result, Friends of the Earth recommends that the Bureau postpone any multi-mineral leasing until the Resource Management Plan for the Piceance Basin is complete and a new lease can be found which will avoid the problems associated with either C-11 or C-18.

If the Department feels that it cannot delay action to encourage multi-mineral leasing, it should lease only tract C-18 and it should adopt the additional mitigation proposals contained in our detailed comments.

We would like to thank Ellen Hirschberg Geier and Charles Griffith for their assistance in preparing these comments.

This submission corrects and amends the version of our comments submitted on 21 September 1982.

Sincerely,

Kevin Markey
Colorado Representative

Connie Albrecht
Colorado West Representative

**Detailed Comments by Friends of the Earth on Proposed New Prototype Oil Shale Leasing**

Because of the impacts anticipated for the action proposed by the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program, and because of deficiencies in land use planning, proposed mitigation measures and terms and conditions in the proposed prototype oil shale lease, Friends of the Earth believes that the intended action should be postponed and be reconsidered after preparation of the Resource Management Plan for the Piceance Basin. These comments will detail our concerns.

## Inadequate Land Use Planning

To speed leasing to test multi-mineral extraction technologies, the Bureau of Land Management (BLM) has chosen to base its proposed action on the existing Management Framework Plan for the White River Resource Area. We do not believe that this document offers an adequate multiple use basis for oil shale leasing decisions. By BLM's own admissions in discussions with Friends of the Earth during the past years, the MFP does not consider regional conflicts, only site-specific, has a non-existent social resources component, lacks adequate water and air quality baseline, and does not adequately integrate mineral resource conflicts. (126)

Our review of the MFP reveals additional problems. Most serious is the basis for the minerals recommentation that eight oil shale tracts be available for leasing (with their restriction to new techologies). The recommendation was based only on geologic and mineralogical criteria without regard to other resource conflicts. The MFP did, in fact, identify many site-specific resource conflicts. One of the most serious was the conflict with critical winter range for the White River deer herd. These conflicts do not affect the ranking of the proposed oil shale tracts. Regional conflicts such as air quality and social conflicts of all sorts are ignored by the MFP.

To be consistent with legal requirements, the BLM limited the scope of its call for industry expressions of interest to the eight tracts identified by the MFP. It also added the sodium lease tract, claiming consistency with the MFP. (We are not as confident as BLM that the inclusion of the sodium lease was in fact consistent with the MFP).

Being limited in this way, to tracts originally identified by nominations more than a decade ago, to tracts ranked only according to geological criteria, seriously constrains BLM's range of alternatives. As an example, consider tract C-1, ranked number VIII in the MFP. Its location further north may help avoid serious cumulative air quality impacts with tract C-a under a westerly wind; its location closer to Rangely may help offset the burdens of population growth on Rifle and (possibly) Meeker. (125)
It does not conflict with critical deer winter range, although





its remote location has been conducive, according to the 1973 Prototype Leasing EIS, to a very diverse wildlife population. Yet, its mineral potential is reportedly limited. **Is there another, more minerally promising tract with some of the advantages of tract C-1?** The range of possible alternatives in the EIS does not at this time permit an answer to that question. Moreover, by limiting the scope of review in the EIS to industry nominations, BLM cannot even address the potential advantages of C-1 relative to C-11 or C- 18.

Other conflicts are also ignored by the EIS. Although FOE does not support open pit extraction over other options -- we do not believe adequate information exists to judge among technologies today -- BLM should not eliminate future high resource recovery options by decisions today. Tract C-11 is within the area which may eventually be open pit mined (overburden/ore ratio is less than 1 for 25 gpt shale). Tract C-18 mostly avoids this area, but if the cutoff grade becomes 20 gpt, C-18 may be able to be partially open pit mined. These conflicts were not considered in (127)
the MFP, and they are not analyzed in the present EIS. Underground mine workings, together with the problems associated with the leached zone, may make future surface mining difficult or expensive. The EIS should at least evaluate lease terms and conditions which will require backfilling to mitigate the loss of resources and allow future mining in the unmined portions of the proposed leases.

BLM is also handicapped by the lack of selection criteria adopted in advance of its leasing and tract selection process. The adoption of preliminary tract selection criteria was originally (128)
proposed by the Undersecretary's Oil Shale Tract Force, but was dropped in BLM's present haste to lease.

Thus, we believe that BLM should postpone its decision on this lease, evaluating alternatives after the completion of the Resource Management Plan.

## Socio-Economic Impacts and Their Mitigation

Human Service Analysis Deficiencies

The environmental statement reveals serious problems will result from already proposed shale projects and from the intended action because of community impacts. However, the statement is still deficient in its analysis. BLM is particularly negligent in its proposal of ways to mitigate impacts which it admits will be severe or very severe.

It used to be fashionable to overlook the analysis of socioeconomic impacts because of all the "intangibles" involved -- a tangle of complex problmes that simply cannot be quantificed. Unfortunately for BLM, this is no longer the case. There now exists an arsenal of resource material. Rather than providing a complete bibliography, we would reference the bibliography attached to the Garfield County 1982 Human Service Delivery Plan as (129)
an example of the body of literature not drawn upon by this EIS.

Considerable data and state-of-the-art analysis such as this is ignored by the analysis in the EIS. Two other documents demonstrate the state of socioeconomic assessment techniques which BLM should be using: the Chevron Shale Oil Company Clear Creek Project's socioeconomic assessment and existing conditions prepared by BMML and the Garfield County 1982 Human Service Plan. The inadequacy of the EIS can be properly measured and corrections guided with either document. Now to specifics:

Social problems are insufficiently addressed and presented in a whimsical fashion in the narrative and in a theoretical manner in Table IV-18, masking the grave negative consequences of boomtown problems that will befall old-time residents. We are told that at full production, "some permanent negative effects would have occurred, some lives would have been touched by marital disturbances or divorce, ...some of the elderly and the young would suffer from losses of social support systems. There are winners, impacts would be short term. ...In the long term, many of these problems give way to beneficial effects -- housing and infrastructure improvements, diversification of retail and services..." [Emphasis Added]

The question that was not asked and the analysis which is missing is "who are the winners and who are the lossers?" No income or age breakdowns are provided on existing residents in the region, so that it is impossible to assess the potential human damage among the residents. According to a 1979 Colorado West Area Council of Governments (CWACOG) housing study, 15% of the residents in western Garfield County were elderly, either in the "low" or "very low" income categories. U.S. Bureau of Census data on per capital income, median income and distribution of household income for the three county area all indicate that historical income levels are low.

Had a complete profile been provided, presenting these and other facts such as rental price estimates, it would be plain to see that the majority of old time residents would be the "short term" (and possibly long term) losers. As was the case in Parachute during the summer of 1981, short term pressure became so severe that long term residents fled during the peak of the boom, leaving "long term" benefits to financially well-off newcomers who had the means to rise above it. The casual conclusions made in the narrative are without factual basis. Demographic characteristics of the regional population, such as age, sex, racial/ethnic composition, income and educational attainment need to be considered at the very least, before analyses can be made about the benefits of these alternative actions. (51) (52)

Table IV-18 indicates that certain groups may experience problems, but no detail is provided on what those problems may be. While data exists on such difficulties as child abuse increases and juvenile crime increases in Garfiled County, there is no survey of social problems provide by the author's of the EIS. Nor is there any information on service utilization levels experienced thus far in the 3 county area as a consequence of boomtown growth. Such is the case, even though this data is (5) (30)





easily available in the documents mentioned above. Also missing is data describing social problems experienced in other areas of the country, state and region, such as Craig and other Rocky Mountain energy boom communities. At the very least, currently available data on the frequency and type of social problems and service utilization in Garfield County needs to be reevaluated to provide a realistic assessment of who will be the beneficiaries and the victims of the proposed leasing program.

The EIS should also evaluate the human service capabilities of the affected communities -- health care, social services, mental health, recreation, youth services, senior services, etc. Social problems and human service needs should be forecasted in the EIS and monitored on a continuous basis by the lessees as a stipulation of their lease. (130)

Cost and Manpower Analysis Deficiencies

The EIS makes no projective assessment of the demand for capital brought about by the various alternative actions. Nor is there any effort to identify the consequences of private market failures. While tremendous problems could result, as they did in Colony's situation, from shortages and inflation in the housing and commercial sectors, no detailed analysis is provided to show who is responsible for providing housing and other private venture capital. Tables indicate potential public revenues, but not in relation to total needs, both public and private. (124)

There is likewise no effort to identify detailed public sector costs generated by the alternatives. Data on prospective public sector revenues is meaningless outside of this context, without any comparison with increased cost estimates, broken down by county and community. (118)

There is no detailed analysis of manpower needs or the availability of local labor needed for each proposed alternative action. The omission results in underestimation of the size of the in-migrating workforce because the authors falsely assume that many construction jobs will be awarded to local laborers. However, without labor data broken down by skill, there is now way the local area can prepare people to compete for these skilled jobs. The Denver Research Institute (Gilmore & Stenejem, Oil Shale Development: The Need for and Problems of Socioeconomic Impact Management and Assessment) found that 1.5% of the Wheatland (Laramie, Wyoming) workforce originated locally, while a 20% local workforce had been forecasted. Some numbers are available from C-b, Union and Colony on origin of workforce. Informal interviews with Parachute residents during the summer of 1981 indicated that the same situation existed with respect to Colony hiring of outside workers. (One must be careful, however, of the methodology used by companies in determining origin of laborers in their surveys.) (131)

Considerable attention has been given the work of the Cumulative Impact Task Force recently. However, its work has not yet been subject to public scrutiny. The coordination and standardization

339

38

of impact assessment by the CITF may be a valuable tool in the future once the bugs are worked out of the system. Lease stipulations should require the use of CITF consistent methodologies. Initially the EIS should include CITF data so that it can be publicly evaluated and compared with BLM's analysis. (132)

Proposed Mitigation Inadequate

Despite the deficiencies of its analysis, the EIS does recognize the potential gravity of the social and economic impacts of the proposed alternative actions. However, despite this recognition and the possibility that after the full analysis recommended in our comments more serious problems may emerge, the proposed lease and other committed mitigation is woefully inadequate.

This deficiency is more serious because of the possible federal preemption of local land use law under the Mineral Leasing Act (Ventura County v. Gulf Oil Coorporation). While there are still legal disputes concerning the extent of this preemption, the consequences of not fully acknowledging the necessary role of local governments in determining the best mitigation strategies cannot be overlooked. Therefore, BLM must and should acknowledge the role of the local government in lease stipulations.

Friends of the Earth proposes several approaches to deal with mitigation deficiencies: (77)

o The lease should require the agreement to a mutually acceptable mitigation plan by the three or four most important parties: (1) the lessee(s), (2) all significantly affected local governments, (3) the State, and (4) the BLM as a condition for approval of any proposed detailed development plan. The BLM's presence as a party to the contract would be necessary to enforce its terms as part of the tems of the lease. Any violation of the plan would be a viplation of the lease.

o The socioeconomic "assessment report" required by Section 15 of the environmental stipulatins of the proposed lease, while a step in the right direction, should be a full socioeconomic mitigation plan, consistent with our suggestion above.

o The lease should include an additional section which requires the lessee to pay advance royalties, creditable to royalties which actually become due later under section 7, as the Secretary or the Mining Supervisor determines they are necessary to meet front end socioeconomic costs of affected communities to the extent that other revenues do not meet those needs. This determination should be made at the request and with the consultation of affected local and state governments. (133)

o Other economic terms and conditions of the lease should be improved (see below) to result in adequate revenues to meet local needs.

o The proposed action ignores most of the excellent recommendations made by the socioeconomic subcommittee of the Undersecre-



38

tary's Oil Shale Task Force in 1930. These recommendations should be added to the lease terms and conditions: (1) transport plans for employees, products and materials, (2) coordination and consulation with local government in approval of the detailed development plan, (3) specific requirements for monitoring social variables, (4) compliance with all state and local laws and ordinances to the extent that it would not interfere with the purpose of the lease, (5) a coordination mechanism for cooperative impact mitigation, plus BLM actions outside the leasing process. (77) (78)

o Also, BLM should require the filling of detailed real-time labor data and the provision of training for local residents to ease in-migration. (77)

The history of energy develoment in the West indicates that if socioeconomic problems are not avoided, in advance of development, not only will the suffering of individual residents be increased, but the developer will experience reduced productivity, higher costs, and long delays. DRI (op cit, above) found that construction productivity can be reduced as much as 35%. This does not mean that BLM can rely on each company's self interest to enforce good planning and mitigation. The history of western energy development is rife with examples of companies who ignored their best interest, to their own detriment, and more important, to the detriment of the community.

In discussions during recent BLM hearings, industry representatives responded to these suggestions not too friendly. They suggested that there would be an administrative usurpation of legislative perogatives for BLM to require the mitigation plans which we herein propose. We do not agree.

In particular, Ventura v Gulf provided that a decision to lease was not only a legislative decision, but that the Congress authorized the leasing of oil by an administrative agency and the local government could not reverse that adminstrative decision. If BLM decides, administratively, to share some of its police powers with local governments in order to make its leasing actions more socially sound and (ultimately) economically sound, there is nothing to stop it from doing so. Moreover, the presence of BLM in any negotiations with local governments, and proper drafting of lease language to require the contract we propose, can reserve to BLM adequate safeguards of its decision to lease. (77)

BLM's "No-Action" Assumptions

It is reported that industry has severely criticized BLM's baseline oil shale industry growth assumptions which it used in evaluating the impacts of the "no action" alternative. We cannot agree with this criticism. Also, we think that BLM's "warnings" to the decisionmaker to take into account the current depressed state of the oil shale industry is misguided. (4)

First, just as economic conditions have rapidly changed to depress the future of the oil shale industry, so they can (and have in the past) just as quickly reversed to encourage unmanageable growth. Just a few months ago Exxon was touting the benefits of a huge multi-million barrel per day shale oil industry. Today, Exxon's Colony project is in mothballs. Tomorrow could quickly reverse this.

Friends of the Earth is presently preparing an economic assessment of the future of the oil shale industry. We regret not being able to share the entire report with BLM, but can report some preliminary conclusions. The conclusions, actually, should come as no surprise, but should be noted and considered.

The three most serious barriers to the shale industry are high interest rates, flat oil prices, and high technical uncertainty which demands high rates of return for these projects. Reduction of interest rates requires action by the Federal government to reduce deficits. There is finally some movement in this direction (although, in our opinion, at the expense of the wrong sectors of the economy) and interest rates have at lease temporarily started to decline and stabilize.

Oil prices depend on international affairs and the success of world-wide conservation efforts. Depending on the cost of the project and the interest rates, an average annual compound growth rate of 3-6% in oil prices could be sufficient to spur the industry once again.

Finally, high required rates of return made be reduced by actions by the Synthetic Fuels Corporation and by the experience of early synfuels projects.

Together, these conditions may in fact obtain. However, even if they do not occur for many years, they are likely to occur suddenly and affect all projects simultaneously. Thus, the decision by BLM to evaluate what many may think will be the "worst case", may in fact be the only case. It is true that the actual effects may not be felt in the years predicted by the EIS (whether social or environmental in nature). However, it is quite possible that all the projects, plus the leases in the proposed action, will see simultaneous development. The consequences will therefore be consistent with the presently proposed no-action baseline and other proposed actions.

BLM's planning regulations also require the agency to assume a "worst case" analysis whenever uncertainty makes a more definitive analysis impossible or inappropriate. This is certainly the case here. In fact, BLM's assessment is not the "worst case." Present shale company resource holdings can support a much higher daily production rate. The size of the proposed leases could also support higher production than that assumed in the EIS's analysis.





## Technology Assessment Needs and Stipulations

The only significant argument in favor of leasing a new prototype lease is the need to test multi-mineral extraction techniques. However, the lease does not now require the maximum economic recovery of all minerals, including oil shale, nahcolite, dawsonite, halite and other sodium minerals. This is a serious, and for any hope of our support for this program, a fatal flaw in the proposed action. Often BLM officials have argued in meetings where we have discussed this issue that the agency cannot stipulate the use of any specific technology. This is not what Friends of the Earth proposes. We only wish to see an enforceable provision which will prevent a lessee from abandoning the testing of this new technology in favor of continued speculative holding of the land for more primitive techniques. The most effective provision would be a requirement of conservation -- maximum economic recovery -- of all minerals covered by the oil shale and (if applicable) sodium leases. (27)

There is in any case no need for two tracts. On environmental grounds BLM's choice, if not the no-action alternative, should be C-13. On other grounds, too, the choice should be limited to that tract because of the surface mining potential for tract C-11 and because there is not more than one mature technology redy for prototype testing.

We would remind BLM of the dictionary and its own definition of the word "prototype": "first of its kind commercial scale." It is quite clear that Shell's process, proposed in its expression of interest, is immature for a commercial test. Shell claims that is due to the lack of suitable land to test its concept. If this is the case, the EIS should instead evaluate the concept of the "research lease." We have not fully formulated our own thinking on this idea, but the lease would be no larger than that necessary to test new technologies, and might be leased in conjunction with the Department of Energy's oil shale R&D program (but not in conjunction with the Synthetic Fuels Corporation, which is a commercialization agency). Only semi-works scale operations would be allowed, and maybe several tests could take place on the same parcel. Without this option, suggested in our scoping suggestions, the EIS is inadequate in its range of alternatives.

There is also doubt about the maturity of Charter's multi-mineral process. The low resource recovery anticipated for each tract is a sign of the relative unreadiness of these processes. As we suggested in our scoping comments, BLM should at least assess the maturity of these technologies prior to making a decision. The consequences of not doing so is to invite another prototype program failure. Tracts C-a and C-b, initially proposing more mature technologies, have not yet seen development, in part because they were less mature and economically sound than originally expected. The Synthetic Fuels Corporation has developed several criteria for assessing maturity. We urge BLM to use them at the leasing step (assessing preliminary development plans prior to accepting a bid), at the EIS, and at the time of approving the detailed development plan. (19)

## Economic Lease Terms and Conditions

The EIS states that most of the terms and conditions established for the Prototype Program in 1974 will be retained in the new proposed leases despite comment during the scoping process suggesting changes. We think this is shortsighted and wrong. Errors contained in the 1974 leases shouldn't be perpetuated in the guise of experimental purity. One of the goals of the prototype program is to develop management expertise in leasing. Continuing old mistakes does not promote this goal.

One of the most serious errors is the royalty rate assigned oil shale. If one assumes that the average grade of shale is 27 gallons per ton mined, and if one further assumes that shale oil prices are the same as the regional price of petroleum, the old lease and the new ones would result in a royalty rate equivalent to only 71 cents on a $35 barrel of shale oil, about 2.053% of the value of the shale oil. This is inadequate. The final useable product of a coal lease must pay a royalty equivalent to 12.5% of its value. An oil lease requires a royalty equivalent to 1/6 of its market value. Shale oil is the last public liquid hydrocarbon resource. It should not be given away.

The reason for the low royalty rate is simple, as we are explained it by some DOI officials and as we view the history of the prototype program. When the royalty rate was first proposed prior to the publication of the draft prototype EIS in 1972, the price of oil was (according to the MMS Oil Shale Office Royalty Manual) only $3.13. The royalty was set on a tonnage basis to approximate a 5%-of-shale-oil-value using this information. Unfortunately, by the time the lease became effective in 1974, the regional value of oil climbed to $6.82 (id.). Yet, the tonnage royalty was set in concrete based on the earlier $3.13 per barrel oil price. (119)

This error should be changed, at least increasing the tonnage royalty rate to 26 cents per ton for 30 gpt shale, retaining the 1974 oil value index. This is probably still to low, but it will be a step in the right direction.

Diligence provisions of the lease are still inadequate. The past several year's experience should attest to that. They are an ineffective combination of withered carrot and broken stick. For example, the bonus and royalty credits are too low except to encourage some intial spending on tract to avoid these payments but not high enough to actually result in diligent production. It was always a mistake to credit bonuses and royalties with on-tract expenditures instead of actual production royalties. This should be changed.

The broken stick consists of the lease's provisions to require commercial production by the twentieth lease year. As demonstrated in the recent changes in the C-a lease, which we have protested, this is easily revised without so much as adequate public notice.





Diligence provisions are important to ensure an adequate return to the public and to obtain the principal benefits of the prototype program -- experience with new technologies. Without diligence, new federal leases will raise false hopes among a population eager for anything to pull it from its recent economic falls. (106)

We would suggest changing the offset procedures to allow advance and "minimum" royalties to be credit only against royalties which result from actual production. BLM should eliminate the bonus offsets. The present economic situation will probably minimize the size of bonuses, limiting the amount of revenue available for socioeconomic mitigation. Bonus offsets will only reduce this further. In their place, BLM should establish several milestones which must be met to comply with diligence terms in the lease. BLM should also increase the rate of production of recoverable reserves of shale oil assumed in determining "minimum" royalties in the lease from that which was assumed in the 1974 leases. Together with a higher basic royalty rate, this should create adequate incentive for lessees to produce or get off the lease.

## EDF v Andrus Requires More Detailed Analysis of Site-Specific Mitigation Strategies

The consequences of the district and appeals courts decisions in EDF et al v Andrus et al are considerable for BLM. The court ruled that the original leasing EIS is the document by which the Mining Supervisor will judge the adequacy of mitigation and other alternatives assessed at the time of detailed development plan approval. This is a considerable burden, but it means that your document can be challenged if it does not adequately assess those alternatives. Missing, for example, now, are assessments of alternative air pollution controls, alternative site plans, alternative water augmentation plans, alternative water pollution controls, and the like. BLM must analyze these alternatives. We further reference the comments of the Environmental Defense Fund on this matter. (138)

## IIS Is Not The Same As MIS; It Has Some Additional Problems Which Need Analysis

Integrated in situ. proposed for development by the Multi-Mineral Corporation, is not the same as the vertical modified in situ techniques developed by Occidental Petroleum Corporation. As a result, many of the impacts may not be the same as for the so-called "mine-assisted in situ" cited in the EIS.

Occidental claims that high temperatures of retorting render soluble mineral insoluble in its process. (More on that below) However, IIS is a low temperature process. Leaching with a liquor follows retorting. The extent to which the liquor removes harmful constituents, moves them to a new waste stream, or causes new post-abandonment problems is largely unknown. There are some hints in the data submitted to BLM for the preparation of the Superior Land Exchange EIS. BLM should assess this information. (19)

Also unanalyzed is the problem of deep mine methane and other gasses. The problems are well documented by the Bureau of Mines in its experimentation at Horse Draw. This experience should be discussed and mitigating measures should be proposed. (134)

## C-a Is Not C-b Is Not C-11 Is Not C-18 Especially Their Hydrology

In its oral comments, Occidental criticized the EIS relative to its use of the classical Weeks hydrological model for assessing groundwater impacts. Occidental is right in its claims that the Weeks model may not apply to C-a or C-b. However, the hydrology of C-11 and C-18 is not understood as well as the hydrology of the existing leases. It is in fact impossible to extrapolate or interpolate C-a and C-b data to tracts C-11 and C-18. Indeed, according to the EIS (p.72), the transmissivities on C-18 are reversed from other areas in the Piceance Basin. BLM has at its disposal data from C-a, C-b, tract nominations, assessments being performed for the permanent program and Resource Management Plan. It should cite, compare and assess all and their implications for C-11 and C-18. Indeed, it may ultimately be necessary because of uncertainty to choose the classic model or the "worst case." (135)

## Additional Technical Comments

### Wildlife

o Given the potential problems with reclamation, the EIS seems to be overoptimistic about postmining vegetative productivity of wildlife habitat. BLM should reevaluate the impacts on wildlife carrying capacity given: (1) toxic uptake by browse, (2) effects on alluvial springs and artisian springs due to mining and de-watering, (3) the legal inability to require augmentation plans to protect aquatic or other habitat, and (4) the problem of growing deep rooted shrubs needed for browse and cover on spent shale, even with adequate topsoiling. (18) (136)

### Air Quality

o We reference and incorporate the comments of the Environmental Defense Fund with respect to air quality. We wish to stress one additional concern. The industry has severely criticized the model used by BLM for its air quality assessment. We, however, believe that it is crucial to use a complex terrain model to make these assessments. Unfortunately, we are unaware of any industry-sponsored complex terrain model in the public domain. We would be happy to further discuss and comment on which model should be used if industry is willing to make its models available for public scrutiny. Otherwise, we cannot accept the validity of industry criticisms of the model BLM has used. (59)

### Spent Shale

o BLM states that surface disposal will be necessary for surface retorting/underground mining. However, Superior had





proposed the slurry backfill of its mine. Such complete backfill was possible because of reduced volume through recovery of sodium and aluminum minerals. Does BLM challenge Superior's earlier proposal? FOE believes that on the basis of safety, resource recovery, reclamation, and other factors, BLM should in fact require such backfill by stipulation.

o The EIS states that complete high compaction is not practical and eludes to, but does not identify problems resulting therefrom. Please identify the problems. (2)

o Occidental MIS techniques do not, as stated in the EIS, entirely remove the threat of leaching. The only independent assessment of which we are aware is cited by the EIS; yet, Occidental continues to claim there is no leaching. Both the continued high fluoride content of leachates and the poor reliability and temperature control of VMIS result in continued problems.

o The EIS does not contemplate exposure of spent shale due to erosion of topsoil placed on top "in the near future." When is it anticipated and how will BLM respond? We believe erosion and new soil formation as one of the most critical issues extant in oil shale environmental control. (137)

o The public should not fund permanent custodial care. The funds to provide for its possibility (probability!) should be provided in lease payments. (121)

o Stipulations are missing which will address and mitigate all the impacts addressed in BLM's assessment of spent shale reclamation. (18)

### Stipulations Missing

o The general environmental stipulations provided in the lease are not adequate to meet all the problems anticipated by the EIS or our comments. BLM should, in addition: (1) require best available technology for all pollution controls, (2) require mitigation to meet the reclamation challenges posed in Chapters 3 and 4, (3) require long term groundwater monitoring, (4) not allow the mining supervisor to end environmental monitoring until at least 30 years after abandonment of any lease. We reference and incorporate the additional comments by the National Wildlife Federation relevant to this point. (138) (18) (121)

### Actions Requiring Hearing

o Currently, only the environmental aspects of detailed development plan approval are subject to hearing and comment under the lease. All aspects of DDP approval, including socioeconomic and other aspects should be similarly subject to hearing. Moreover, any changes in the lease or any suspensions should be so subject to hearing. Any other pending decisions should be announced at least in the federal register and be subject to comment. (114)

## Energy Alternatives Must Be Reevaluated

In response to several requests to evaluate the energy alternatives to new oil shale leasing, the EIS simply states "The 1973 Prototype EIS examined other energy alternatives to the prototype program. It is believed that this analysis is still valid." We cannot agree. Any analysis completed before 1974 is obsolete. Since this analysis of alternatives determines the need for new leasing (aside from the possible need to test new technologies) -- a requirement of any EIS as required by NRDC v Hughes -- it is crucial to revise the 1973 analysis.

The justification for new leasing presented in the 1973 EIS is the connection between economic growth and energy consumption. Since 1973 this analysis has been thoroughly repudiated both by research and history. DOI estimated that the ratio of energy consumption to gross national product would moderately decline from 93 MBTU per 1958$ in 1971 to 87 MBTU in 1980 and 79 MBTU at the close of the century. Instead, GNP rose faster than DOI anticipated and energy consumption has remained nearly constant. In 1980, the energy demand/GNP ratio was only 42.3 MBTU/1958$ -- one-half DOI's estimate for 1980. DOI estimated that 1980 energy consumption would be 96 quads; it was only 76 quads.

Oil price increases have brought about belt tightening but, more importantly, investments in energy efficiency and shifts in energy feedstocks from oil. We have discovered price elasticity. The marketplace has discovered that conservation and efficiency is cheaper than shale oil. We have also discovered that shale oil is not economically capable of meeting demand for liquid fuel; 1985 production will be only 1% of DOI's 1973 projection. (8)

BLM must revise thoroughly the energy alternatives analysis of 1973 to account for our new knowledge. With respect to the lack of a connection between economic growth and raw energy consumption, we suggest referencing Alternative Energy Demand Futures to 2010 by the National Research Council's Committee on Nuclear and Alternative Energy Systems. For a comparison of costs and a comparison of efficiency and synthetic fuel options, refer to OTA's forthcoming liquid fuels alternatives study (it should be printed soon). Also, we incorporate by reference EDF's comments on this subject.

With costs for gasoline derived from shale oil as high as $12.30/million BTU (ignoring recent cost overruns -- $18/MMBTU accounting for the overruns), shale oil will never be able to compete with efficiency improvements which will largely cost less than $3.50/MMBTU. Refer also to Lovins & Lovins, Brittle Power, for a discussion of comparative costs.





## Conclusion

Except for the deficiencies noted here and by our colleagues, BLM has performed the beginnings of a realistic analysis of the proposed action. Additional analysis must be completed and corrections made. Also, we are not enthusiastic about the land use planning which narrowed tract choices to those BLM offered for expressions of interest. BLM should postpone this proposed action until adequate land use planning is complete. In any case, only leasing C-18 is acceptable, and only with the stipulations cited throughout our comments.

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9-21-82

ENVIRONMENTAL DEFENSE FUND

COMMENTS BY THE

ENVIRONMENTAL DEFENSE FUND

ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

FOR THE PROTOTYPE OIL SHALE

LEASING PROGRAM

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1. Introduction.

The Supplemental EIS for the Prototype Oil Shale Leasing Program ("SEIS") has numerous deficiencies in its scope, the identification and analysis of alternatives, and the adequacy of its analysis of various impacts. Review by EDF has focused primarily on the treatment of alternatives and the analysis of the impact of air pollutants on the human environment. In both areas, we find the SEIS has major deficiencies. These are discussed below.

39

2. Identification and Analysis of Alternatives

The alternatives identified for analysis in the SEIS are extremely limited and do not encompass the scope of alternatives comtemplated by NEPA. The deficiencies in the alternatives analysis are of two kinds: 1) the failure to consider alternate fuel sources as a substitute for oil shale development, and 2) the failure to consider the air quality impacts of alternate siting and technology options for projects not yet permitted or under construction, including the proposed C-11 and C-18 lease sites. The CEQ's NEPA regulations clearly outline the scope of the alternatives analysis. Together, 40 CFR §§ 1502.14-.16 outline both the types of comparisons to be made and the types of alternatives to be considered. 40 CFR § 1502.14 requires that "agencies shall (a) rigorously explore and objectively evaluate all reasonable alternatives...." The alternatives and comparisons to be analyzed as identified in 40 CFR § 1502.16 include, among others,

> (d) the environmental effects of alternatives...,
>
> (e) energy requirements and conservation potential of various alternatives and mitigation measures...,
>
> (f) natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures; and
>
> (h) means to mitigate adverse environmental impacts....

Taken together, EDF contends that significant alternatives are available and should be evaluated to compare the impacts of each alternative on 1) the environment, 2) energy resources consumed to produce the energy product and 3) the need for development of the resource given available conservation options. These alternatives will be addressed as "national policy alternatives," and "regional development alternatives."

A. National Policy Alternatives.

The Secretary of Interior has statutory control over the leasing and development of all federal energy resources. His responsibilities include the rate and geographic scope of leasing, on-shore and off-shore oil and gas leasing oil shale and tar sands leasing. Each of these energy resources is subject to a separate statutory and regulatory scheme. But each will have significant impacts on the human environment, and each will contribute to the nation's total supply of liquid, gas and solid fuels. Given the Secretary's control over the development of each of these resources, he is in a unique position to evaluate and compare the respective environmental impacts of each form of energy development, as well as the energy costs and other economic impacts which will be associated with each form of energy development.

Oil shale development will contribute mostly to the nation's supply of liquid fuels. The need for any additional oil shale development should be considered within the scope of the "no action" alternative. The current price of liquid fuels is largely the result of reduced worldwide demand. Reduced demand in the U.S. is, in part, a result of significant conservation in both the space-heating and



39

transportation demand sectors. Reduced demand has resulted in lower imports. The reduced price has strongly influenced industry decisions to invest in synfuels projects, particularly oil shale.

The directive in the CEQ regulations that conservation be treated as a reasonable alternative to the development of natural, depletable resources should be taken seriously by the Secretary. Conservation should be evaluated as an alternative to additional oil shale development. (B)
At a minimum, the nation's need for liquid fuels should be evaluated in light of the effects of 1) current law requiring substantial improvements in vehicle fuel efficiency by 1985, 2) reasonable programs for retrofitting residential and commercial structures with insulation and other energy-saving conservation measures, and 3) adopting energy efficiency performance standards for new residential and commercial construction. It makes no sense to invest in mammoth energy products which will have predictable adverse impacts on human health from air pollution, cause "acid rain" and associated impacts on land, water and wildlife resources, impair visibility and otherwise degrade pristine environments in order to make heat that escapes out the window. If conservation alternatives can reduce or eliminate the need for further oil shale development, they will be the most effective mitigation measures, and must be considered as reasonable alternatives under NEPA. The fact that conservation alternatives may not be within the jurisdiction of the Secretary is irrelevant. The CEQ regulations make clear that the alternatives analysis must "include reasonable alternatives not within the jurisdiction of the lead agency." 40 CFR 1500.14(c).

A starting point for an adequate conservation analysis should be the opportunities for reducing consumption of liquid fuels in the private transportation sector. Energy policy justifications for government support and expansion of oil shale development have been: to plug the capital drain from the United States; to reduce threats to national security; and to improve regional economic conditions.[1] Rather than investing resource dollars into oil shale development, these national security and energy efficiency improvement benefits may be more economically achievable by investing a fraction of the same capital into the U.S. automotive industry. Improving the efficiency of the U.S. vehicle fleet will meet energy policy objectives at a lower cost than oil shale development, while maintaining, if not raising the quality of the natural environment and the economic health of the auto industry.

Recent research shows that vast quantities of oil are available from automobile manufacturers in Detroit. In an article published in Scientific American "The Fuel Economoy of Light Vehicles" by Gray and VonHippel[2] the authors describe the technical feasibility of producing energy efficient automobiles which take into account demographic changes as well as evaluating improved automobile desing by use of available best technologies and reasonably anticipated new technologies.[3] they suggest that a 60 mpg vehicle fleet, by 1995, is possible without major technological advances.[4] By the year 2000, fuel consumption would be two-thirds that of 1980 or approximately two million (m) barrels/ day (bbl/d).[5] These fuel savings would be roughly more than twice the energy content of the Trans Alaska Pipeline.[6]

The economics of improved automotive efficiency are quite favorable when compared to investment in oil shale development. A 1980 Congressional Budget Office (CBO) study estimates that the incremental investment necessary to improve fleet fuel economies to 40 mpg ranges from $10-$27.5 billion (b) ($1980).[7] Savings resulting from a 40 mpg fleet, when compared to the 23 mpg standard,[8] are .5mbbl/day in 1990, 1mbbl/day in 1995, and close to 2mbbl/day in the year 2000.[9]

By comparison, the U.S. Office of Technology Assessment (OTA) estimates that the cost of a 1mbbl/day oil shale production facility could easily reach $456 ($1979).[10] Output is syncrude, which would then require additional energy and capital for conversion to useable liquid fuels.

The comparison of investment alternatives is: a maximum investment of $27.5 b ($1980) to save 1mbbl/d in 1995 of liquid fuels versus $45b ($1979) to produce 1mbbl/d of syncrude.[11]

The policy goals of improved energy efficiency, reduced military tensions, improving regional economic conditions, and avoiding further degradation to the natural environment can be more economically achieved by revitalizing the U.S. automobile industry through judicious investment in efficiency improvements. These goals may or may not be achieved by public investment or pursuant to Congressional extensions of the fuel efficiency standards. But in either case, continued technological advances are likely to continue achieving reductions in consumption thereby keeping the price of liquid fuels in line with current real costs. At current prices, oil shale is not profitable. See CBO report. Absent evidence that the demand for liquid fuels cannot be met by other supplies, or that oil shale can become profitable in the near term, the Secretary should not risk the drastic environmental consequences that can result from increased oil shale development beyond that level currently planned by the industry.

Equally important is an evaluation of oil and gas drilling, including secondary and tertiary production techniques, and coal liquifaction as alternatives to oil shale development. Recent dis- (8)
coveries and new recovery technologies suggest that oil and gas development offers a much larger potential source of fuel in the near term than was considered likely only a few years ago. The rush to increased oil shale development may not be justified in the light of these discoveries. Oil shale projects already in the stages of advanced planning may be more than enough to meet current demand if traditional oil production rates can be sustained while conservation reduced demand. The air, water, soil and wildlife impacts of oil drilling and tertiary production techniques are substantially less than the impacts oil shale development will have on those resources. To the extent that oil reserves can meet more of the demand than anticipated a few years ago, the Secretary should consider whether oil shale development, and its attendant adverse impacts on the human environment, can and should be proportionally reduced.

With respect to coal liquifaction it is much less clear how the respective environmental impacts of coal and oil shale will trade off. But given the minimal need for solid waste disposal in coal-based





conversion technologies as compared with the massive volumes of spent shale which will be produced by even a modest level of oil shale development, it is quite possible that a careful analysis will show that, on-balance, coal conversion will have a significantly smaller impact on soil and water resources although air quality impacts may be similar. In comparing coal liquifaction with oil shale, it is also important to consider the wide-range of siting options available to coal projects, whereas oil shale can be economically developed in only a few confined regions of the country. Thus the analysis should evaluate the opportunity to reduce the environmental impacts of coal-based conversion by siting policies which separate the projects from sensitive environmental areas (such as parks, wilderness, non-attainment areas, geological formations sensitive to acid deposition and domestic or agricultural water supplies) and avoid over-concentration of pollution sources.

Finally, an analysis comparing various fuel supply and conservation alternatives should include an evaluation of the rates of $CO_2$ (8)
production associated with each. The evidence is rapidly growing to (59)
support the conclusion that $CO_2$ accumulation in the earth's atmosphere will have a dramatic, if not catastrophic, impact on the human environment. The scientific debate has generally shifted in recent years from whether there will be a "greenhouse effect," to how wide-spread that effect will be. Included in the likely affects will be reduced precipitation, reduced agricultural production and increased food shortages for a growing world population. Given the probability of such large-scale impacts within 50 years or less, it is critical that modern industrial society begin the search for either substitutes to current carbon-fuel combustion energy sources, or carbon-based fuels that reduce the rate of $CO_2$ growth in the atmosphere. With this serious environmental problem in mind, alternate sources of fuel should be compared with respect to the amount of $CO_2$ formed by each process per unit of available energy produced. In addition, the economic and technical feasibility of the hydrogen fuel cycle should be considered as an alternate source of energy.

B. Site and Technology Alternatives.

One of the most important variables affecting the air quality impacts of sources in WesternColorado is the location of emission points in relation to major topographic features which influence low-level air movements. Siting a major source in a valley hundreds, or in some cases thousands, of feet below surrounding high terrain will cause emissions from the source to be trapped and concentrated during local inversions. Inversions in the deep valleys of the West Slope occur frequently, especially in winter, and can continue for days. Emissions under the inversion layer can build up to dangerous levels during inversion episodes creating a significant risk of exceeding national health standards.

Conversely, siting sources near ridge tops will guarantee good ventilation under most circumstances. But good ventilation will also increase the likelihood of coherent plumes being transported relatively long distances under persistent wind conditions. Plume transport from sources at higher elevations will significantly increase the likelihood of more frequent high concentrations affecting sensitive Class I areas.

The BLM has some important options at this stage of the process that can mitigate some of the most serious adverse impacts attributable to emissions of air pollutants. First, BLM can select alternate lease tracts which can influence the siting of major emitting facilities within the Piceance Basin. Second, BLM can impose lease conditions which impose siting restrictions, such as the elevation of the major emission points in relation to surrounding terrain. Because of the important differences in air quality impacts which can arise from (125) facility siting decisions, the significant siting options available (139) to BLM at this stage of the leasing process should be evaluated to determine their air quality consequences. If NEPA means anything, it requires that real options available to the decision-maker which can be expected to have significantly different environmental consequences should be identified and compared. That analysis has not been done here.

Terrain features and elevations within the federal oil shale region include significant variations. Within that range of variation, (80) modeling should be performed which evaluates valley trapping and inversion frequencies and durations in the area, and the impacts (139) those phenomena will have on emissions from sources sited at different elevations. Similarly, rawinsonde and lower met data collected by oil shale developers in the region should be evaluated to determine whether higher elevation sites will produce significant increases in (139) concentrations in the Class I area. From these comparisons, rational judgments can then be made regarding tract selection and lease conditions affecting stack heights.

Two other major variables affecting air quality impacts are process technology and control technology. Different processes produce markedly different rates of emissions for equivalent product. This difference seems to be especially notable with respect to HC emissions.

Similarly, different control technology options will achieve more or less emission reduction depending on the systems selected. The emission inventory used for the air quality analysis is not explained and therefore the reader cannot tell what assumptions were made regarding either the processes that will be used on the proto-type tracts, (14 or the control systems to be installed.

The modeling analysis for air quality impacts should attempt to evaluate the air quality differences that would result from increasing or decreasing emission rates within the range offered by reasonably (123) available choices regarding processes and control technologies. This would require a clear statement of the processes under consideration, and an assessment of available control technologies. If the analysis shows that air quality impacts are sensitive to the variation in emission rates that would result from consideration of these factors, then the decisionmaker should be informed of those differences and (138) offered a choice of options as part of his consideration of alternatives and mitigating measures.







3. <u>The Air Quality Analysis</u>.

The Air Quality analysis performed to analyze the impacts of new oil shale leasing on air quality or air quality related values is deficient in a number of respects. These deficiencies include both assumptions in the modeling performed for the analysis, and a failure to consider impacts that are likely to affect the human environment. The most important of these deficiencies are discussed below.

3.1 The winds model simulates only the lowest layer of the atmosphere.

It is incapable of handling inversion trapping or valley drainage and accumlation. Air Quality Impact Assessment for the Supplemental Environmental Impact statement for the Protytype Oil Shale Leasing Program, hereinafter referred to as AQIA, 34. This incapacity is dismissed as important to regional scale impacts (ACIA 54). (80) However, there are cases in which these phenomena can be important to regional scale impacts. The severity of regional impacts is strongly related to the effective initial concentration of pollutants. If pollutants accumulate for a period of time before transport, the effective initial concentration will be larger than if direct transport takes place, so that both local and downrange impacts will be increased during accumulation episodes.

Certain impacts are related to chemical conversion. This is especially true for visibility and acid deposition impacts. Accumulation of precursors prior to transport makes the effective travel time longer and allows more time for conversion resulting in greater impacts. This increase can be of even larger dimension if there is accumulation from different sources, leading to possible synergistic source interactions. Wilson, William E.<u>et.al</u>., 1977: <u>Sulfates in the Atmosphere</u>, Research Triangle Park, North Carolina, U.S.E.P.A. publication number EPA-600/7-77-021.

A full and fair discussion of impacts as required in 40 CFR 1502.1 must include modeling which explicitly treats such exacerbating phenomena as inversion trapping and valley drainage accumulation. (80)

3.2 Visibility analysis was not done at a sufficiently detailed level.

Visibility impacts were analyzed at the EPA level 1 state. This analysis showed that there is a potential for plume visibility at Flattops Wilderness Area if the MAIS process is used at the 50,000bpd level. The normal procedure (Workbook for Estimating Visibility Impairment, EPA-450/4-80-031) would involve a level 2 or 3 analysis, usually (140) including a numerical model of visibility impacts. This analysis was not done because the required "level of information" was said to be "beyond the scope of the Prototype analysis". AQIA 118. However, "[a]ir quality impacts, particularly as the affect Class I areas and wilderness areas" was identified as a "significant issue" of the Prototype EIS. Draft Supplemental EIS for the Prototype Oil Shale Leasing Program, hereinafter refered as Prototype DEIS,p.17. The Flattops Wilderness Area is just such a Class I area. It is inevitable that some incertainty in estimates of impacts from sources not yet constructed must be tolerated. But there must at least be enough information to be "useful in...maintaining..." the quality of the

environment. The impacts of $SO_2$, $NO_x$ and TSP were explicity modeled in the Prototype DEIS. There is no indication that the "level of information" required for a similar analysis of visibility impacts is any different than the emission terms used for the analysis of the criteria pollutants. If the assumptions made regarding source terms are adequate for making an air quality analysis, those same assumptions should be suitable for a visibility analysis. Indeed, explicit visibility modeling was done on a largely overlapping region, with uncertainties seemingly no greater in the Draft EIS for the Uintah Basin Synfuels Development (hereinafter refered to as the Uintah DEIS). (140)

Any visibility analysis should include an evaluation of the impact of emissions on regional haze as well as plume blight. In most cases, plumes will disperse so that at the distances involved here plumes will not be apparent. But the contributions to regional haze could cause perceptible changes in visibility.

The National Park Service found this to be true in its analysis of the visibility impacts of emissions from multiple sources on Theodore Roosevelt National Park. See Notice of Intent to Issue Certifications, 47 Fed.Reg., 3022(July 12, 1982) and associated technical analysis. In the Theodore Roosevelt case, the NPS found that each proposed source would pass the Level I Visibility Analysis, but collectively the sources would cause increases in fine particulate concentrations sufficient to cause perceptible reductions in standard visual range.

Using modeled concentrations of both primary particulates and secondary particulates (sulfate) from the proposed sources, NPS calculated reductions in standard visual range within the Class I boundary using the Koschmieder correlation between fine particulates and visual range. The same technique is appropriate here for estimating the impact of major source emissions on visibility in Class I areas.

Visibility impacts should be evaluated because they are one of the most likely impacts of new source emissions on Class I areas. The fact that EPA's visibility regulations focus on plume blight is no reason for excluding regional haze impacts. The Clean Air Act visibility protections do not distinguish between plume and regional haze impacts. Both should be addressed in the EIS. A full and fair discussion of significant impacts must include a complete discussion of visibility impacts.

3.3 Ozone concentration was not modeled.

Although ozone is recognized as a "pollutant of concern, since ambient concentrations are high," AQIA 44-45, ozone analysis was not independently done in the statement. Instead, reliance was placed on results of another draft EIS (the Uintah DEIS) which concluded that a $10^6$bpd oil shale production level would produce only 60% of the ozone standard concentration. Simple reliance on another, as yet unaccepted draft EIS does not provide insurance of scientific integrity of the type required by 40 CFR 1502.24. The methods and data must be critically reviewed to determine if the results are sufficiently reliable to justify entirely foregoing an analysis specific (141)





to this EIS. This review is particularly important in this case, because there are several questions about the methods used in the Uintah DEIS. The upper model layer concentration of $O_3$ and $NO_x$ are not specified in the Uintah DEIS, so the amount of entrainment is uncertain. The conclusion that there will be compliance with NAAQS's is based on the assumption that high ozone background values are unrealistic. The model predicted that there may be exceedances if the background values are higher than those assumed to represent background concentrations. Such higher background values are acknowledged to exist in the technical report for the Prototype EIS (AQIA 44-45)

Indeed some measured ozone value are in exceedance of the NAAQS primary standard. (Prototype DEIS Table III-2). These large values are dismissed as being the result of transport or stautospheric entrainment (AQIA,p.18). However, no analysis of the published values for ozone was made to determine whether such values represent actual air quality in the area or what the causes of such concentrations might be. (142)

Data obtained by EDF from the files of the BLM show that sites other than the site reported in the DEIS are also reporting similarly high concentrations of ozone. (See Table I). It is impossible to determine how representative those high values are without an evaluation of the data base than that presentated in Table III-2. There are more ozone data available for the region than set forth in Table III-2. (See Exhibit 1).

Such high values of ozone as have been observed must be included as representative of the background concentration for the worst case scenarios unless an analysis using accepted scientific methods and procedures demonstrates that these values do not represent actual air quality in the region. The Uintah Basin DEIS is deficient in that it does not give consideration to the measured ozone concentrations in the region. For this reason, the Prototype EIS cannot rely on the Uintah Basin EIS's analysis for ozone.

Assuming that measured ozone levels in the region represent actual air quality, the impact of new sources should be considered in light of those concentrations. The degree to which new source emissions will affect the frequency of high ozone levels above 200 ug and above the NAAQS should be evaluated. Such an evaluation requires both an air quality modeling analysis of the ozone which will result from $NO_x$ and HC emissions from the new sources, and also an analysis of the frequency distribution of measured background concentrations. The analysis of background measurements should include an effort to determine whether high ozone concentrations can be correlated with measured groundlevel concentration of $NO_x$ and HC, with expected seasonal periods of high ozone concentrations, or with transport into the area from distant sources. Some have suggested that the peak levels of ozone are associated with stratospheric intrusions. This theory should be tested by comparing the hours of peak measurements with the passage of storm fronts that might cause intrusions, determining whether the peak hours occur during periods when high levels would be expected if the ozone were formed in the lower atmosphere, and an analysis of the six hours on either side of the peak hours to determine whether the concentrations

Table 1

Maximum Measured $O_3$ Value at Various Sites in the Oil Shale Region (ug/$m^3$)

| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|
| Cb Oil Shale Site | | 151[1,5,6] | 124[1,6] | 164[1,6] | 160[1,6] | 246[1,6] | 154[1,6] | 155[10] |
| Ca Oil Shale Site | | (178)[2,5] | (178)[2,5] | | 176[2] | 160[2] | | |
| Anvil Points Oil Shale Site | | | | | | | 206[3] | 265[3] |
| Chevron Clear Creek Site | | | | | | | 94[4] | 152[4] |
| White River Oil Shale Project | (190)[5] | (190)[5] | 220[7] | (160)[9] | (160)[9] | (160)[9] | (160)[9] | (160)[9] |
| Mack Power Plant | | | | | | | | 150[11] |
| Union Oil Shale Project | | | | | | | | 136[12] |
| Paraho (UT) Site A-6 | | 150/150 | 140/140 | 160/160 | 137/137 | 151/149 | 143/143 | |

parenthesis indicate multi-year maximum

(Reproduced in Exhibit 2)

Sources:
1. Cb Annual Report, Vol 2,April 1981
2. Rio Blanco Monitoring Report #7,No. 1980
3. Anvil Points 1981 Interim Data Report,No.1981
4. Chevron Clear Creek Annual Report, 1980-81
5. A Preliminary Assessment of the Environmental Impacts From Oil Shale Developments. EPA-600/7-77-069.
6. Cathedral Bluffs PSD Application
7. White River Detailed Development Plan,Vol.1

(Available at EPA Region Office)

8. TOSCO PSD Permit Application
9. White River Shale Project PSD Application
10. Ca Quarterly Report #7
11. Colorado-Ute Mack Site Meteorology and Air Quality Monitoring Program
12. Union Oil Quarterly Report

39



39

are normally distributed for the twelve hour period or whether the peak values are isolated events appearing as outliers for the day.

These analyses are important because if the high values in excess of the NAAQS are representative of regional air quality, then the area must be considered a non-attainment area. Accordingly, any new sources of HC would require offsets from existing sources contribution to ozone formation in the area. If ozone is formed by emissions from local sources, the liklihood of obtaining offsets and the costs should be considered in the EIS. If the ozone is transported into the area from distant anthropogenic sources, offsets may be hard to identify. If the ozone orginates from natural sources, than offsets may be unavailable and any planning for sources that will add to local concentrations of ozone should not proceed.

Failure to 1) consider available data showing background levels of ozone, 2) scientifically evaluate the contributions of planned or permitted HC sources to ozone formation in the study region, 3) evaluate the contributions of new sources on the proposed prototype least tracts to ozone concentrations in the study region, and 4) address how exceedances of the national health standard will be prevented is inconsistent with NEPA. A final EIS which fails to evaluate and consider these factors will certainly be inadequate for the purpose of sustaining a final decision by the Secretary to lease new oil shale tracts. (141)

3.4 Total acid deposition and the probable impact of acids on sensitive areas of the affected region were not addressed.

There was no attempt to quantify the amount of acid wet deposition. "Acid rain" was identified as a "specific concern" in the Prototype DEIS,p.17. Acid deposition is of particular concern" in the intermountain West because of the extreme sensitivity (because of low buffering capacity) of many of the mountain lakes and streams, Lewis, Wm. M. 1982: Limno. Oceanogr. 27,167-172. A full and fair discussion of significant impacts must include a quantitative assessment of both wet and dry acid deposition. As discussed in 2.1 above, this analysis of acid depositions must include consideration of the effects of inversion trapping, valley drainage and other phenomena that can cause pollutant accumulation or prolong travel time. Because receptors vary widely in their sensitivity to acid depositions, of impacts can only be identified if both the quantity and severity of the deposition are correlated without a more specific and reliable analysis of acid deposition impacts, the public and the decision maker can not make a reasoned decision among the alternatives without knowing what the impacts of projected emissions of acid-forming pollutants will be. (7)

Two extreme methods can be used to estimate the amount of total acid sulfur deposition occuring in a region. These methods bracket from above and below the true value of sulfur deposition. We can use airborne $SO_2$ and sulfate concentrations to calculate the total dry deposition. Alternatively, we can add to this quantity an upper limit to the wet deposition, calculated by assuming that all aerosol and $SO_2$ which passes through an average rainstorm is deposited.

Dry deposition may be estimated from the expression:

$$F_D = [N(SO_2)V(SO_2) + N(SO_4)V(SO_4)]T$$

Where $F_D$ is the total dry deposition per unit area, T is the length of the year, $N(SO_2)$ and $N(SO_4)$ are the ground level annual average airborne $SO_2$ and sulfate concentrations (in terms of weight of sulfur per unit volume), respectively and $V(SO_2)$ and $V(SO_4)$ are the deposition velocities of $SO_2$ and sulfate, respectively. Values of $V(SO_2)$ and $V(SO_4)$ for terrain in the west central U.S. have been compiled by Sheih et.al. (Atmospheric Environment 13, 1361, 1979). These values are time-averaged. In reality V will vary diurnally and seasonally. But for the purpose of estimating annual deposition, a single well-chosen value of V for each component will suffice. An upper limit on wet deposition may be calculated by assuming that the entire local mixing layer is cleared of sulfur during a local precipitation event of average size. Thus where $F_W$ is the total wet deposition of sulfur

$$F_W = [N(SO_2) + N(SO_4)] \times H \times N$$

per unit area, H is the mean mixing height and N is the number of rainstorms per year with size greater than some cutoff. Of course, since sulfur is fed into the local air parcel during rainstorms, this method may under-estimate wet deposition.

Experience in the eastern U.S. and in Europe suggests that $F_W$ is about equal to $F_D$. So as a crude approximation, in the absence of western U.S. data, $F_D$ may be doubled to get total sulfur deposition. In order to perform these calculations, background $SO_2$ and sulfate concentrations and incremental increases must be available. If only $N(SO_2)$ is available, a lower limit on total sulfur deposition may be calculated from

$$2\,N(SO_2)V(SO_2).$$

Extensive studies have been performed on sensitive aquatic ecosystems in order to determine a level of sulfur deposition which is "safe", that is, which is not accompanied by acidification of surface waters. Based on studies in Europe and eastern North America values greater than 0.5 $gmS/m^2$-yr are accompanied by acidification of surface waters over a period of one to three decades while lower values may lead to acidification over a longer time scale or may not lead to any significant acidification. Thus, values above 0.5 may be regarded as unsafe, whereas values below 0.5 may or may not be regarded as "safe", but are much less likely to cause significant adverse impacts in the near-term.

Report of the 1982 Stockholm Conference on Acidification of the Environment, Stockholm, June 28-30, Swedish Ministry of Agriculture;

U.S. Canada Memorandum of Intent on Transboundary Air Pollution, Report of the Working Group on Impact Assessment, February 1981.







In order to apply the current methodology for assessing impacts, one needs to determine the sensitivity of Colorado water resources to acidification compared to that of eastern and European aquatic systems. Such evaluations are generally based on the alkalinity available from rock and soil types underlying the water resources. If the sensitivities are comparable to those found in low buffered areas of the Northeast such as the Adirondacks, then a value of 0.5 $gm/m^2$-yr may be compared with the results of equations (1)-(3) to determine if damaging levels of acid sulfur deposition are approached. Comparisons of the sensitivity of receptor areas should be feasible based on comparing the measured alkalinity of water bodies with those in the Northeast, or by comparing bed rock types. Alkalinity is reported for some Flat Tops lakes by Turk, John T., and Dee B. Adams, "Sensitivity to Acidification of Lakes in the Flat Tops Wilderness Area, Colorado," U.S. Geological Survey (1982). The values reported by Turk should provide a basis for estimating the effects of deposition rates calculated as proposed above.

3.5 Impacts of emissions of carbon monoxide were not analyzed.

While an encyclopedic discussion of all conceivable impacts is not required in an EIS, regulation require that for impacts only briefly discussed, there be "enough discussion to show why more study is not warranted." 40 CFR 1502.2. "Statements... shall be supported by evidence that the agency has made the necessary environmental analysis." 40 CFR 1502.1.

Some mention is made of the "background" concentration of CO, but there is no discussion of the impacts expected under the various alternatives. This omission is particularly in violation of the requirement for a showing of no significance because:

1) The PEDCO study (1982), relied on in the Prototype DEIS for estimates of "background" concentration, projects that CO emissions with oil shale development in Rio Blanco, Moffat and Garfield counties will increase well above the 100 ton per year significance criterion established for PSD application. There must at least be a demonstration that developing of proposed C-11 and C-18 tracts will not result in the threshold CO emission increases which will trigger PSD review as projected for other oil shale projects. If this demonstration cannot be made, then there should be a full analysis of the air quality impacts of CO emissions from both baseline sources and the prototype lease sites. (141)

2) Reported CO concentrations (Table III-2) show a several-year trend of increase, approaching the NAAQS's. The states 1981 CO data are available. These data indicate this toward the NAAQS in the Grand Junction area is continuing. These data should be evaluated to determine the significance of increased CO emissions caused by development of C-11 and C-18. This analysis should include both direct emissions from the oil shale projects, and "secondary emissions" (See definition 40 CFR § 52.21) attributable to VMT growth associated with both the baseline oil shale development and development of the prototype sites.

3.6 The impact of hazardous pollutants were not analyzed.

There is no discussion of the impacts of hazardous pollutants such as heavy metal or radioactive compounds. If these are not significant issues, the prototype DEIS must contain enough discussion to (1) assure the reader that a sufficient analysis if its significance has been done and (2) explain the basis on which a determination of non-significance is based.

4. The analysis fails to reliably identify and model worst case scenarios.

Probably the single most serious deficiency of the Air Quality analysis is the failure to evaluate the impact of emissions on important impact areas. For example, no analysis is made of the impact of oil shale sources and secondary emissions on the TSP non-attainment area in Grand Junction. This is one area where public health is most clearly at issue, yet it is given no consideration whatsoever. (143) If oil shale emissions will exacerbate the health hazards from TSP concentrations, the public and the decision maker should be informed. Ignoring these impacts constitutes a gross violation of the letter and spirt of NEPA.

An adequate analysis of TSP impacts within the non-attainment area must also include a discussion of the opportunities for, and costs and benefits of obtaining offsets. The identification of available offsets would be a legal requirement for sources that will contribute to the non-attainment concentrations. Offsets must be identified before the Secretary could determine that new projects on the prototype sites could lawfully proceed if emissions from those sites will contribute to the now attainment area.

Other important impact areas not considered are Colorado Category I areas (§ 25-7-209,C.R.S.), Arches National Park in Utah and geologically sensitive areas (i.e.,low buffering capacity) outside of the Flat Tops Wilderness. (143)

Evaluation of impacts on these receptor areas require modeling of many wind directions in addition to the three directions selected for the analysis. In addition, an adequate analysis of total sulfate and $SO_2$ deposition in the region requires an annual modeling run to predict cumulative concentrations from which total deposition can be estimated. (85) (145)

More specific deficiencies with the analysis reported in the draft EIS are set out below.

4.1 The assumed "influencing" winds may not represent a worst case scenario for the Flat Tops Class I area.

The surface wind field is diagnosed from a single "influencing" wind, which is assumed to be at 4 m $sec^{-1}$ and steady in direction for 24 hours. Five candidate wind directions are proposed and three are chosen for analysis by a "screening" process. Because the wind field





over complex terrain can be quite sensitive to large scale influences, it is important to screen a sufficiently large number of candidates so that the worst case can reasonably be expected to have been "caught." The candidate wind directions were chosen to represent straight line trajectories from sources to sensitive receptors. Because the wind field is perturbed by topography, the trajectory will not be straight line. Thus the trajectories might miss the receptor which is "aimed at." An example of this can be seen in the NW wind case. See especially figure 3-22 to 3-27 and figure G-67 of the AQIA. The plume from the Craig power plant passes to the east of the Flattops Wilderness area and stagnates. The wind trajectories for the NW and W winds (figures G-8 and G-9 in the AQIA) indicate that under the influence of a NNW wind, the Craig power plant plume might mass, and possibly stagnate directly over the Flattops Wilderness area. It cannot be known if NW winds represent a worst case with respect to plumes from the proposed projects unless other plausible worst case scenarios are modeled. The requirement for a worst case analysis means that a sufficient number of wind directions must be modeled to assure that a worst case is actually simulated.

The assumption of steady winds precludes the simulation of certain worst case scenarios. A worst case wind scenario should allow for the possibility that the plume may meander in such a way as to pass over several sources. A comparison of figures G-38 and G-65 indicates that if the wind direction shifted from WSW to NW after 20 minutes of simulation, the trajectory would likely have included plumes from the Rio Blanco, Cathedral Bluffs and Superior projects. A worst case analysis must include such wind direction shifts as will induce the largest reasonably foreseeable plume interactions. (144)

4.2 The worst case scenarios are not pollutant-specific.

The meteorological situations conducive to worst case impacts are different for different pollutants. For species with high deposition velocities, such as certain TSP, long range transport is not an important factor, but for gaseous pollutants it will be. Similarly, unreactive pollutants are not extremely sensitive to changes in travel time but pollutants such as ozone and sulfates are.

As discussed in 4.1, the worst case scenario for reactive pollutants should include such meteorological situations as inversion-trapping, valley drainage, and convoluted trajectories. Even these scenarios should be tailored to fit the worst-case characteristics of the pollutants with respect to insulation, humidity, plume intractions, etc. For example, for $SO_2$ conversion rates and thus visibility impacts may be maximized under moderate dispersion, because of increased entrainment of $O_3$ (PLUVUE user's guide) while, all other things equal, $O_3$ impacts may be maximized under condition of minimal dispersion. In this EIS, acid dry deposition is estimated from the west-wind scenario which was assumed to be worst case for $SO_2$, TSP and $NO_x$. There is no reason to believe that it will also be worst-case for either acid dry or wet deposition. It is clear that with longer travel time caused by a convoluted trajectory or episodes of stagnation, sulfate formation will be greater prior to deposition on sensitive terrain downwind, and therefore acid deposition will be increased. (145)

4.3 Emission inventories may not be consistent with a worst-case analysis.

Emission inventories were obtained from the Bureau of Land Management EIS office. No further information is given concerning the nature of this inventory. To be consistent with a worst case analysis, this inventory should reflect the full capacity of the facilities. Region Workshop on Air Quality Modeling, April 1978, EPA O.A.Q.P.S. The requirement for a worst case analysis and insurance of scientific integrity means that the basis of the emission inventory must be stated and that this basis should be full capacity production.

The inventory used in this analysis is generally lower for both total emissions, and emissions from individual project sites, as compared with the inventory used in the Uintah Basin analysis. An example of this discrepancy is shown in Table 2. (146)

Table 2. Comparison of Uintah DEIS and Prototype DEIS

Estimates of TSP Emissions (kg/m)

| | 2000-2003 | | 1990-1993 | |
|---|---|---|---|---|
| | Uintah | Prototype | Unitah | Prototype |
| Colo. Oil Shale Emissions | 1,503 | 1,174 | 818 | 511 |
| Other Colo. Emissions | 22,314 | 852 | 20,877 | 745 |
| Total Colo. Emissions | 23,817 | 2,026 | 21,695 | 1,256 |

These figures represent total emission for the region of Colorado modeled (the Uintah DEIS includes certain Utah sources as well).

The discrepancy for "other" sources is understandable, since the Prototype DEIS did not include in its modeling such area sources as off-site road dust, railroads, etc. However the large differences in projections for oil shale emissions (and similar differences for $SO_2$ and $NO_x$ emission) are not discussed. The requirement for insurance of scientific integrity, 40 C.F.R. 1502.24, means that there must be an explanation for the differences between oil shale emissions projected by the Prototype DEIS (derived from the BLM EIS office) and those projected by the Uintah DEIS (based on "applicant-supplied data").

4.4 The assumed surface temperature precludes simulation of certain worst case phenomena.

Surface temperature for the WINDS model was held constant in time at 20°C at 1800 m elevation, and changed by 6.5°C for each km of elevation change. Holding temperature constant through the simulation period precludes any modeling of diurnally varying thermal winds, such as slope winds. Assuming that temperatures vary only with height precludes any modeling of winds induced by differential





heating on north and south facing slopes. These unmodeled effects are likely to increase pollutant concentrations in low elevation areas by contributing to valley drainage/accumulation, (see 2.1) meandering of trajectories (and thus increase of travel time) and deflection of trajectories over different sources. (see 3.1) For example, under the influence of an inversion, sulfur compounds might accumulate in the Piceance Creek and White River Basins during the night where conversion to $SO_2$ can take place. With sufficient daytime heating, up slope flow could entrain the polluted air mass up the valley walls into the "free" atmosphere, possibly affecting the Flattops area. This type of scenario was identified as a worst case situation in S.A.I. report No. 81274, pp 12-15. The surface temperature assumptions made in the prototype DEIS preclude modeling of these types of scenarios.

The validation studies of WINDS indicated that the "temperature field must be represented in complete detail for the model to provide realistic and verifiable results." AQIA C-16. To comply with the requirement for a full and fair discussion of impacts the temperature field should be set to vary in space and time and in a manner consistent with observations in the oil shale region. Failure to use detailed temperature fields is inconsistent with the proper use of the model, and casts into serious doubt the validity of any conclusions drawn from the model.

4.5 Mixing depth assumptions may not represent the worst case.

A spatially uniform mixing depth was assumed for the dispersion model CITPUFF. As a worst case assumption, an average daily minimum mixing depth was calculated at 800 m. However, this depth was applied at the maximum elevation of the model, viz. the 3500 m elevation at Flattops, so that the mixing depth was set at 4300 m ASL for the entire modeling domain. This means that the mixing depth over much of the modeled area ranged to above 2,000 m. Over the southwest portion of the model, it was as much as 3,000 m, more than 1,000 m above the average daytime minimum mixing height (AQIA 60). Such deep mixing heights over much of the modeling region allows plume dispersion which is not representative of either worst case, or even typical, situations. This is because CITPUFF plumes are allowed to disperse to the height of the mixing layer before being "reflected." An unrealistically high mixing layer allows an excessive amount of dispersion to take place, thus lowering ground level concentrations. This feature of the model is particularly objectionable when modeling is done to predict impacts on important low elevation features, such as the TSP contributions to the Grand Junction non-attainment area, and the $SO_2$ contributions to the Category I areas at Dinosaur National Monument and Colorado National Monument. To perform worst case analysis, CITPUFF must be modified to accept a terrain-following mixing height or, if this is impossible, another model more suitable to the region must be used. (80)

5. Application of the WINDS model does not comply with recommended procedures.

The grid spacing necessary for resolution of local winds in the WINDS model is related to topographic variation. It is stated that 1 km grid spacing is appropriate if terrain variation is 1,500 m over a 10,000 $km^2$ area, and that grid spacing should be reduced by 1 km for every 300 m increase in terrain variation (AQIA C-16). Since 0.5 km grid spacing is the minimum the model will treat properly, this would seem to imply that the model is not valid for terrain variations of more than 1,800 m. (147) It is not clear how this scheme should be modified when applied to the present modeling region of over 50,000 $km^2$. The terrain variation over the modeled region is approximately 2,300 m. Moreover, the grid spacing used was 2.86 x 3.7 km. This is clearly outside the model application guidelines set forth on AQIA C-16 for a 10,000 $km^2$ region. To comply with the requirement for insurance of scientific integrity, there should be a sensitivity study over a 50,000 $km^2$ domain with at least 2,300 m variation, to determine if the grid spacing used provides sufficient resolution of local winds to realistically simulate plume trajectories.

6. There is insufficient assurance of scientific integrity.

6.1 Verification for WINDS and CITPUFF does not provide an assurance of scientific integrity.

WINDS was verified by runs over San Diego County and the Oregon Cascades. The latter verification procedure is more representative of the type of complex terrain found in the oil shale region. However, these verification runs were done only for daytime conditions. Thus, thermal winds such as slope winds and sea breezes, which typically reverse directions during evening hours, were not verified. Slope winds are of great importance in the oil shale region. (33) The validation data reported in Appendix C of the AQIA may give an unrealistically favorable picture of the ability of the WIND model to simulate a 24 hour period, as was attempted in the prototype study.

The only validation of CITPUFF mentioned is a comparison to predictions of other models. This provides the reader with no information on CITPUFF's ability to simulate reality. To comply with the requirement for insurance of scientific integrity there must be a comparison of the model with observations collected during conditions similar to the conditions which were modeled.

6.2 Predictions of impacts are inconsistent with predictions made in the Uintah DEIS

As noted above (3.3) the emissions used in prediction of impacts (247) for the Prototype DEIS were significantly smaller than those used in the Uintah DEIS. Never-the-less the impacts predicted by the Prototype DEIS are significantly larger. For example, TSP concentrations near Rifle, Colorado were predicted by the Prototype DEIS to be 704 $ug/m^3$. The comparable Uintah DEIS prediction (near Parachute) was 80 $ug/m^3$. The Prototype EIS predicted $NO_x$ near Rifle



of 4,100 $ug/m^3$. The Uintah DEIS (derived, as suggested, by multiplying $SO_2$ concentrations by $NO_x/SO_2$ emission ratios) is asserted to be less than 100 $ug/m^3$. While no two modeling efforts can be expected to produce identical results, some of these discrepancies are over an order of magnitude. The assurance of scientific integrity requires that there be an explanation for the differences so that the public and the decision maker can have a reliable basis for choosing among alternatives. Otherwise, the decisions suggested by the two DEIS' may be contradictory.

7. Conclusions stated in the text are inconsistent with data shown in tables and in plots of concentrations.

The EIS states that the only exceedance resulting from C-11 and C-18 emissions (which would not occur under the no action alternative) is a projected $SO_2$ concentration of 9.4 $ug/m^3$ (of which 5.0 $ug/m^3$ is attributable to the lease sites alone) east of the Flattops area, assuming an "influencing" wind from the west. This does not comport with the data presented in the AQIA. (31)

A comparison of figure 3-22 with 3-25 and 3-23 with 3-26 shows that under a NW wind, the isopleths delineating the shape of the region of exceedance for TSP and $SO_2$ near Rifle, Colorado all different for the "no-action", "all sources" scenarios. So, while the prototype may not cause the appearance of a new region of exceedance, it will change the location and extent of the region of exceedance.

The modeling methodology allowed for calculation only of 24-/m concentrations. The simulation of $NO_x$ exceedances, which has an annual average standard, thus is lacking. Though the probability of exceedance is large, given the size of some of the 24-/m concentration predictions, the reader is unable to form a clear idea of where and to what (83) degree the $NO_x$ standard will be exceeded and what the contribution of the C-11 and C-18 sites will be. A full and fair discussion of the impacts of $NO_x$ emissions must include explicit modeling of annual average $NO_x$ concentration.

8. BLM's proposal to promote additonal air pollution by leasing the prototype tracts is unlawful. } (1)

The Bureau of Land Management (BLM's) Organic Act, Federal Land Policy and Management Act (FLPMA), 43 U.S.C. § 1701 et.seq., sets forth the responsibilities of the BLM in the management of the public lands. FLPMA provides that the management planning and development of public lands be carried out in compliance with applicable federal and state pollution control laws. 43 U.S.C. §§ 1712(c)(8), 1732(a)(b), 1733(g).

FLPMA requires the Secretary of Interior (Secretary) to provide for compliance with pollution control laws, including state and Federal air....pollution standards or implementation plans," in the development of land use plans. 43 U.S.C. § 1712(c)(8). Section 1732(a) governing the management, use, occupancy and development of public lands requires the Secretary to "manage the public lands.... in accordance with the land use plans developed by him under section 1712." 43 U.S.C. § 1732(a). Subsection (b) of section 1732 states that the Secretary shall "regulate, through...leases...the use, occupancy, and development of the public lands," in a manner consistent with FLPMA and "other applicable law." 43 U.S.C. § 1732(b). (emphasis added) This subsection, therefore, requires the Secretary to enforce air pollution laws through lease "terms and conditions."

Finally, section 1733, in setting forth the Secretary's responsibilities regarding enforcement of management, use, and protection requirements, states that:

> The use, occupancy, or development of any portion of the public lands contrary to any regulation of the Secretary or other responsible authority,...is unlawful and prohibited." 13 U.S.C. § 1733(g).

The regulations of the Administrator of the EPA and state air pollution control agencies promulgated pursuant to the CAA constitute regulations of "responsible authority [ies]" which constrain the use and development of public lands.

These provisions of FLPMA indicate that BLM must conduct its planning and management processes in compliance with Federal and state pollution laws and regulations. In requiring the BLM to manage public lands in compliance with federal and state air pollution standards, Congress clearly intended BLM to issue leases only when the available data indicates that such leases could be developed for their contemplated uses without causing or aggravating violations of federal and state air quality standards.

BLM's Prototype Leasing DEIS indicates that emissions of air pollutants for all existing and proposed pollution sources within the study region will cause exceedances of the national ambient air quality standards (NAAQS's) for $SO_2$, $NO_2$, and TSP. The increment analysis for the proposed oil shale lease tracts indicates that these projects will cause incremental increases over the predicted concentration for each of these pollutants. By issuing the leases BLM would, therefore, be allowing exceedances of NAAQS's to be exacerbated. BLM will be in violation of FLPMA if it issues leases for the prototype tracts when its own EIS data indicates that such development







will aggravate exceedances of NAAQS's.

Accordingly, EDF contends that it will be unlawful for the Secretary to approve new leases for additional oil shale development unless he can firmly establish that other sources included in the baseline analysis will not be built, and that the prototype tracts can be developed without contributing to violations of the Colorado SIP or any NAAQS, or any PSD increment. The DEIS record perpared to date does not support such a showing.

Respectfully submitted,

Robert E. Yuhnke

Richard Hughes

Michael Koved

## FOOTNOTES

1. OTA, An Assessment of Oil Shale Technologies (Washington, D.C.) p.16.

2. Charles Gray, Jr. and Frank VonHippel "The Fuel Economy of Light Vehicles." Scientific American May 1981, Vol. 244, No. 5, pp 48-59.

3. Design Improvements includes reduction in vehicle weight, reduced acrodynamic drag, and power train redesign. For more detailed description see Solar Energy Research Institute. A New Prosperity: Building A Sustainable Energy Future. (Andover, Mass.: Brick House Publishing) p.300. Also see Scientific American Vol. 244, No. 5, p.51-56.

   Demographic changes include matching future car design with anticipated family size, ages, and driving patterns. See Scientific American Vol. 244, No. 5, p.51.

4. Scientific American, May 1981, p.48. It should be noted that investments in these measures are cost-effective. See p.58.

5. Ibid., p.49.

6. According to Gray and VonHipple (Scientific American, May 1981) 15 percent of U.S. oil production is from Alaska. In 1980, the roughly 1.5mbbl/d from Alaska has a BTU content of 8.7 E12/day [Assumes 5.8E6 BTU/bbl (Energy Data Card, Energy and Resources Group, Univ. of CA, Berkeley, 1981) and 42 gallons per barrel. Gasoline is assumed to have a BTU content of 125,000 BTU/gal. (Energy Data Card) or 5.3E6BTU/bbl. If energy savings are 2mbbl/d, then fuel savings are 1.83 greater than the energy content of TAPS.]

7. SERI. 1981 p.304. Congressional Budget Office. Fuel Economy Standards for New Passenger Cars After 1985. (CBO: DC Dec. 1980).

8. Scientific American May 1981 p.59.

9. Ibid., p.57.

10. OTA. 1980 p.218.

11. A synthetic crude produced by adding hydrogen to crude shale oil. (OTA 1980 p.3)



**Department of Energy**
**Washington, D.C. 20585**

2 1982 '82 SEP 27 AM

Mr. George C. Francis
State Director
Colorado State Office
Bureau of Land Management
1037 20th Street
Denver, CO 80202

Dear Mr. Francis:

The Draft Supplemental Environmental Impact Statement (EIS) for the Prototype Oil Shale Leasing Program, prepared by the Bureau of Land Management (BLM), has been reviewed by various offices of the Department of Energy (DOE). In particular, the Laramie Energy Technology Center, DOE's lead center for oil shale research and development, the Office of Fossil Energy, and the Office of Environmental Protection, Safety, and Emergency Preparedness, which includes the Office of Naval Petroleum and Oil Shale Reserves, have reviewed the Draft Supplemental EIS. Our consolidated comments are provided in the enclosure.

As you know, dramatic changes affecting the oil shale industry have occurred in recent months, which are not reflected in the draft EIS. We are also concerned about the apparent lack of consistency between various reported air quality analyses. Since the information presented in the BLM EIS impacts DOE programmatic oil shale objectives, we request that these comments be carefully considered in the preparation of the final EIS.

We appreciate your willingness to extend the comment period on this EIS due to the late arrival of review copies at DOE Headquarters. We would welcome the opportunity to discuss our comments with you in further detail, if desired. In this regard, you may wish to contact Dr. Robert J. Stern, Director, Office of Environmental Compliance (FTS: 252-4600). We hope you will find our comments helpful.

Sincerely,

William A. Vaughan
Assistant Secretary
Environmental Protection, Safety, and Emergency Preparedness

Enclosure

cc: Oil Shale Projects Team Leader, BLM

Department of Energy Comments - Draft Supplemental EIS for the Prototype Oil Shale Leasing Program

Characterization of Existing Environment

Dramatic changes affecting the oil shale industry occurred less than 5 weeks after the public scoping meetings with the announced closing of the Colony Oil Shale Project and subsequent decisions by Rio Blanco, Chevron, and other companies to slow down their oil shale development. The Colony decision, especially, altered the socioeconomic conditions in western Colorado, significantly changing the baseline BLM presents in the draft EIS for Rifle and Meeker, Colorado. Instead of boomtown growth, the western slope of Colorado is now facing high rates of unemployment: Garfield County - 12.8%, Rio Blanco County - 7.1%, and Mesa County - 9.6% (June 1982 data). Rather than examining these changes, BLM has presented a description of the existing physical and social environment and environmental consequences which no longer has a basis in fact. We urge BLM to reflect these changes in the final EIS. (4)

Air Quality Impacts

The discussion of air quality impacts references scenarios and emission factors used for BLM's Uintah Basin Synfuels EIS, but arrives at different conclusions. This is especially confusing due to the near simultaneous release of both documents. These differences should be rectified by careful examination of the model and data inputs by both BLM offices involved, so that compatible analyses are presented. Furthermore, we urge BLM to select a standard model for future work on the upcoming Oil Shale Programmatic EIS.

The air quality impacts presented in the draft EIS differ significantly from results of a separate study performed for BLM by Systems Applications, Inc. of San Rafael, California, for the Uintah Basin Synfuels EIS. (Air/Water Pollution Report, August 16, 1982, p. 322.) This study predicts limited air quality impacts from proposed synthetic fuel projects in the Uintah and Piceance Creek Basin of Utah and Colorado. The report concludes that only 2 of 17 projects under consideration are likely to violate the stringent ambient air quality standards near the Flat Tops Wilderness Area. (14) (146) (247) (248)

Improved meteorological and emission factor data, and improved models, are needed to better predict air quality impacts of shale development. The EIS should reflect the limitation of the present models and the extent to which they may represent a "worst case" analysis. (14) (32) (59) (79) (146)





Due to the nature of this draft EIS and the Uintah Basin Synfuels EIS, the projected air quality impacts could affect the development of future oil shale facilities in Colorado, Wyoming, and Utah. Special care should be paid by BLM to the accuracy of the predicted impacts. We invite BLM to consult with the DOE and the Environmental Protection Agency (EPA) on the model used to predict the air quality impacts in order to present the most technically defensible results.

Multi-Mineral Development

The development of multi-mineral lease tracts C-11 and C-18 presents socioeconomic and environmental impacts which BLM discusses solely as oil shale related. This discussion should also include the impacts associated with the production of dawsonite and nahcolite. BLM does not address whether production of these minerals will likely be simultaneous with shale oil or sequential. The production scenario and its socioeconomic and environmental effects might be staged in a manner which could modify peak impacts and serve as an effective mitigation measure. It could also present an alternative to be considered in a future Detailed Development Plan, if the tracts are leased. (148)

Spent Shale Disposal

The discussion of spent shale disposal should be moved from Chapter III to Chapter IV, since shale piles are not present in the existing environment but will be an environmental consequence. (6)

The DOE's Laramie Energy Technology Center (LETC) has been involved in intensive research on spent shale disposal and leachates. Recent studies have shown the cementation of shales to be a carbonaceous reaction which appears to lack long-term stability. Engineering studies on pile stability, compaction, and other engineering properties of spent shale have been conducted on the largest spent shale pile in the United States at Anvil Points, Colorado. (2) Further relevant information can be obtained from James Westhoff (DOE/LETC, 307-721-2274).

LETC has also been involved in large scale leachate studies in conjunction with the American Society for Testing Materials.

3

The studies have investigated the applicability of hazardous waste regulations to spent shale and development of standardized leaching tests for a large variety of shales. Further information and results are available from Larry Jackson (DOE/LETC, 307-721-2255).

Other Comments

o An alternative use of excess mine waters is the creation of wetlands habitat. Studies using oil shale wastewater to create wetlands have been underway for the U.S. Fish and Wildlife Service (FWS) and have focused specifically on excess mine water (Synfuels Week, August 9, 1982, p.3).

o To facilitate better public understanding, we suggest that BLM use the term "modified in situ" instead of "mine assisted in-situ". This would be consistent with the practice of DOE, EPA, U.S. Geological Survey, Minerals Management Service, Colorado Mined Land Reclamation Division and other Federal, State, and local agencies. (149)

o The directional orientation of Figure III-II should be included on the diagram to assist persons not familiar with the geology of the Piceance Creek Basin. Additionally, since Yellow Creek is discussed throughout the draft EIS and is presented as recharging from the aquifers as shown in Figure III-II, it should appear on this figure. (150)



UNIVERSITY OF COLORADO AT BOULDER
Boulder, Colorado 80309 Campus Box 483

Growth Impact Group INSTITUTE OF BEHAVIORAL SCIENCE

September 20, 1982

George C. Francis, State Director
and
John Singlaub, Team Leader
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, Colorado 81641

Dear George Francis and John Singlaub:

Thank you for your reference to the 1981-82 segment of the Growth Impact Group study, on page 88 of the DEIS for the Prototype Oil Shale Leasing Program. We are pleased that the study has been of such immediate use.

However, we must point out your error in citing our work. The citation given on page 253, under "Boulding, Elise, et al.", is totally incorrect. The correct citation for our report should be:

Lillydahl, et al. 1982. Quality of Life, Expectations of Change, and Planning for the Future in an Energy Production Community. Boulder, CO: University of Colorado.

The first author of the report is Jane H. Lillydahl, NOT Elise Boulding. The Growth Impact Group is affilitated with the Institute of Behavioral Science at the University of Colorado at Boulder. No member of the Growth Impact Group has ever been affiliated with Denver University. (6)

We hope you will correct your records accordingly.

Sincerely,

Elizabeth W. Moen
Project Director,
Institute of Behavioral Science
Associate Professor, Sociology

EWM:ig

42

# J. PHYLLIS FOX CONSULTING SERVICES

1988 California Street, Berkeley, CA 94703
(415) 845-0983

September 20, 1982

John Singlaub, Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, CO 81641

Dear Mr. Singlaub:

I have reviewed the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program, and my specific comments are listed on Attachment A to this letter. These focus on the water-related aspects of this EIS due to the short time available for review. The references cited in my review comments are listed in Vols. 2-5 of the BLM report, "Literature and Data Search of Water Resource Information of the Colorado, Utah, and Wyoming Oil Shale Basins."

I do not believe that this document adequately fulfills its stated purpose. It contains many technical errors, is based on numerous improper assumptions, contains inconsistencies among alternatives and analytical methodologies, it is poorly referenced, and the information it is based on is quite outdated. Many specific examples of these shortcomings are presented in my comments in Appendix A.

The Summary on p. 3 and the Issues and Concerns on p. 17 clearly state that one of the purposes of this document was to update the 1973 Prototype EIS. This is not achieved, and the majority of the information in this EIS is no more current than that presented in 1973. The authors of this report are not familar with oil shale in general and oil shale environmental research in particular, as is evidenced by the reference list. Many excellent and current reviews of most topics pertinent to this EIS have been prepared in the past five years. Most of these have not been referenced in this document. Many hundreds of research reports have been published in the past 10 years on leaching, revegetation, effluent composition, wastewater treatment, hydrology, etc. Less than 5% of these are acknowledged in this report. Many that are referenced are poor





42

choices and do not reflect current scientific consensus (i.e., Crawford et al., 1977).

This is undoubtedly due to the very short time that was alloted to the preparation of this EIS and to its unfortunate timing with respect to several BLM contracts that were to supply the requisite information (i.e., Literature and Data Search of Water Resource Information of the Colorado, Utah, and Wyoming Oil Shale Basins, etc.).

This report needs to be extensively modified to correct technical errors and expanded to reflect the current state of knowledge. In particular, the literature searches on water resources, wildlife, etc. that were completed during 1982 should be incorporated into this document. Because of the massive revisions required, this EIS should be resubmitted for public review prior to additional leasing under the Prototype Program.

Sincerely,

Phyllis Fox, Ph.D.
President

## Appendix A

### Comments on Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program

by

J. P. Fox

CHAPTER II

1. The description of the No Action Alternative on p. 24 does not state what technology is assumed (i.e., in-situ or surface retorting) for tracts C-a and C-b. I also was unable to find any statement of assumed technology for these two sites in other sections and chapters of the EIS. It is essential for the reader to know what technology is assumed so that subsequent assumptions and analyses can be evaluated. (151)

2. The estimated water requirement of 8,000 ac-ft/yr from the White River per 50,000 bbl/day production (for tracts C-a, C-b and proposed leases) requires justification. Much of the water demand will be met by treated mine water and process water, considerably reducing White River diversion requirements. This is clearly stated in the BLM EIS on the Proposed Superior Oil Company Land Exchange, in Detailed Development Plans for tracts C-a and C-b, in various assessment reports (i.e. Fox, 1980; Nevens et al., 1979), and it has been recently evaluated by the U.S.G.S. (Alley, 1982). The justification for the use of 8,000 ac-ft/yr should be clearly discussed. (152)

CHAPTER III

1. The reference, Fox (1980), first appearing on p. 72, is missing from the reference list. It is incorrectly listed under Berkeley (1980) in the references. (6)

2. The second sentence in the second complete paragraph on p. 72 is attributed to Fox (1980). Although well yields are discussed in that report, the yield values in this sentence are not from that report. The correct reference should be used or the numbers revised to correspond to those cited by Fox (1980). (2)

3. The last sentence of the section on Groundwater Quantity on p. 72 states that the report, Piceance Basin Spring Hydraulics Investigation, was prepared <u>for</u> the Colorado State Engineer <u>by</u> the U. S. Geological Survey. The reverse is true. The report was prepared <u>by</u> the Colorado State Engineer <u>for</u> the USGS. (6)

4. The section on Groundwater Quality on p. 72-73 should be expanded to include more recent data, and specific numerical





values or ranges which are cited in the text should be referenced. The majority, if not all of this section, is taken from Weeks et al. (1974). This should be stated in the first paragraph on p. 72. The extensive monitoring programs at tracts C-a and C-b have greatly expanded the available groundwater quality data for the Piceance Basin. This new information should be reviewed and interpreted, particularly as it relates to trace elements. (Note that this new data was summarized in Fox, 1980.) (2)

5. The last sentence in the section on Groundwater Quality states that "The boron and lithium levels are high enough to be toxic to most plants". This is true only for boron. Most plants can tolerate Li concentrations up to 5 mg/l, and the Li concentrations reported by Weeks et al. (1974) range from 0.01 to 6.5 mg/l; only one out of the 10 reported values exceeded 5 mg/l.

6. The sentence fragement, "with approximately 80 percent of the <u>surface runoff</u> in the basin being supplied by groundwater (<u>Robson 1981</u>" on p. 75, second column, first complete paragraph, should read "with approximately 80 percent of the <u>streamflow</u> in the basin being supplied by groundwater <u>(Weeks et al., 1974)</u>. (6)

7. No references are given for the data in Table III-9, p. 73.

8. Table III-9, the relevant text in Chapter III, and surface water analyses in Chapter IV focus on the station, White River near Ouray, Utah. This station is very far downstream from the area of interest, and it would be more relevant to this EIS if a closer station were selected. Reasonable choices include the White River near the Utah-Colorado State Line or the White River near Watson, UT. The reason for this emphasis on a geographically remote station should be presented in the text on p. 75. (153)

9. The section, Surface Reclamation and Solid Waste Disposal, p. 98-105, only discusses surface spent shale. No discussion is provided of in-situ spent shale. The disposal technology, geotechnical considerations, and hydrogeochemistry are very different, and both surface and in-situ spent shale should be discussed. (Note that the 1973 EIS also omitted in-situ spent shale.) Since the stated purpose of this supplement to the Prototype Program is to extend it to other technologies, specifically, true in-situ processing (p. 14 this EIS), it is important that in-situ solid waste disposal be discussed. (154)

10. The majority of the discussion in the section, Surface Reclamation and Solid Waste Disposal, is outdated, technically incorrect, and reflects a lack of understanding of the issues and concerns involved. This section needs to be extensively revised and expanded. Some of the more problematic areas are discussed in subsequent comments.

11. The section, Expansion of Spent Shale, p. 101, states that the volume of spent shale increases about 20%, compared to raw shale. This is correct but the explaination of why this is so is (155)

incorrect and should be deleted or corrected.

12. The section, Compaction of Spent Shales, p. 101, contains technical errors, improper word usages, and misinterpertations of the principal reference (Bloomsfield and Wells, 1980). It also is limited in its coverage of the literature, relying on a single overview report on USBM research. The entire section should be rewritten to correct technical errors and updated to reflect current knowledge. Some specifics are:

- The second sentence in the first paragraph should read: "Spent shale compacted to <u>90 to</u> 100 pounds per cubic foot would result in good strength ..." (156) The last sentence in this paragraph, "Compaction to this level....on a large scale" is incorrect and should be deleted. The reference (Bloomsfield and Stewart, 1981) clearly demonstrated that compaction to this level was readily achievable using standard compaction equipment (see p. 21). (157)

- The first sentence of the second paragraph is meaningless and should be deleted.

- In the third paragraph, the term "compaction strenght" is used. The correct term is "compressive strength". (2)

- The reference, Bloomsfield and Steward (1981), only discusses Paraho and TOSCO spent shale. Each spent shale is unique, and generalizatins are not appropriate. This section generalizes the results from Paraho or TOSCO to all spent shales, without proper qualifications.

13. The section, Leachates of Shale Disposal Piles, p. 103, is based exclusively on a brief report by Bloomsfield and Stewart (1981) and on an article by Stollenwerk and Runnells (1981). These are not "overview" reports, and this discussion does not reflect present state-of-knowledge of spent shale leaching. Over 100 research reports that address this topic have been published since the 1973 EIS. These were recently reviewed (A Critical Review of Oil Shale Leachates, Fox 1982). This literature should be evaluated to identify important environmental concerns (i.e., codisposal, volatilization from pile surface, microbial transformation of metals to more toxic compounds, construction impacts), and the section extensively revised to reflect current knowledge. (158)

14. The section, Underground Shale Disposal, p. 103-104, only discusses the technology of underground disposal and does not address the more important water impacts of this method. Backfilled mines may be leached by groundwater when dewatering is terminated, in a manner similar to the leaching of in-situ retorts. The resulting leachates will be transported in the local aquifers and eventually discharged to surface streams. (2)

15. The section, Aboveground Shale Disposal, on p. 104 does not reflect the present state-of-knowledge and requires extensive





revision and expansion. This topic has been reviewed recently by Redente et al. (1981) and Redente and Doerr (1982) in the Proceedings of Oil Shale, the Environmental Challenges. These reviews should be used to update and improve this section. The title of this section should be changed to reflect the fact that it deals with revegetation of spent shale piles rather than above ground disposal. (159)

16. The section, Location of Shale Disposal Piles, p. 105, should be expanded to include a discussion of the effects of pile location on local recharge areas and on alluvial aquifers. (111)

17. The section, Monitoring of Shale Disposal Piles, p. 105, implies that consolidation of spent shale minimizes leachate quality. The opposite is true. Increased compaction reduces the void space and, thus, the water-to-solid ratio in the mass of the pile. This <u>increases</u> the concentration of most parameters in the leachate. Compaction <u>decreases</u> the <u>rate</u> of leachate escape from the pile.

CHAPTER IV

1. A special appendix should be prepared which describes the hydrologic analyses summarized on p. 131-141. The EIS does not provide sufficient information to evaluate this material. (2)

2. The discussion of Mine Dewatering on p. 132 variously states that the pumping rate during the first seven years was 2.5 cfs (third paragraph) and 26.5 cfs (fifth paragraph). Page 137, third paragraph under Impacts to Piceance and Yellow Creeks states that the pumping rate during this same period was 37.5 cfs. This should be resolved.

3. The discussion of excess mine water in the last paragraph in the section on Mine Dewatering, p. 132, and the subsequently described Mine Dewatering with Reinjection Wells calculations are inconsistent with the assumption, stated on p. 24, that all of the project water will be withdrawn from the White River. (155) Also, Colorado water law may prohibit the use of tributary groundwater. This legal point should be addressed. (2)

4. The rapid recovery of the dewatered area, noted in the second complete paragraph in the second column on p. 132 and shown in Figure IV-8 is suprising and disagrees with other simulations in the area. This other work (i.e., Mehran et al., 1980; Brown, 1978) has shown that recovery is an extremely slow process due to the large void volume in the retorted region (what assumptions were made regarding recovery of resources in these model runs?) and the very low hydraulic conductivity of the upper aquifer. Mehran et al. (1980) found that the average rise in the phreatic surface was approx. 1.8 ft/yr, compared with about 400 ft/yr in this work. If the model used in the EIS did not consider saturated/unsaturated flow, this could partly explain the difference. The reason for this rapid recovery should be explained, considering the sizeable literature which demonstrates (160)

the contrary.

5. The section, Impacts to Existing Sources, p. 133, and Figure IV-9, present information on regions where drawdowns exceed 10 feet. It is not clear whether these drawdowns are due only to dewatering at the two new leases or to the new leases plus tracts C-a and C-b. Figure IV-9 should also show regions where drawdowns exceed 10 feet for the No Action Alternative.

6. The last sentence in the first paragraph on p. 134 should be modified to read: "The contaminants which are most likely to increase are pH, sulphate, sodium, chloride; certain trace elements including vanadium, molybdenum and lead; and certain organic compounds such as phenols and organic nitrogen..." Carbonate and bicarbonate should decrease in leachates compared to groundwaters due to precipitation reactions. This is discussed in Peterson et al., 1982. (2)

7. The discussion of leachate transport in the last two paragraphs of the section, Leaching of Subsurface Retort Chambers, p. 134, should be revised. This discussion is based on Fox (1979). These estimates were revised to reflect new data from tracts C-a and C-b, and the revised estimates were published in Fox (1980), referenced elsewhere in this EIS.

8. The reference to Table III-10 in the first complete paragraph on p. 137 is incorrect. The correct table is IV-8. (6)

9. The analysis of ground and surface water quantity and quality impacts of the No Action Alternative (see p. 131, 133, 137, 140) is based on the scenario used by Robson and Saulnier (1981). I believe that this scenario differs from the No Action Alternative used in this EIS and described on p. 24. The same model and assumptions should be used to analyze both the No Action Alternative and the Development Alternative. Otherwise, comparisons between the two are not relevant. An additional model run should be performed for the No Action Alternative __or__ differences between the two scenarios should be carefully detailed and their impact discussed. (161)

10. Page 137, second column, first phrase, indicates that water use estimates are based on 4 barrels of water per barrel of oil. This water use rate may be __low__ for recovery of saline minerals due to the large amounts of water required for mineral separation (see BLM EIS on Superior Land Exchange.) A section should be added to this EIS that discusses water use at the proposed lease tracts and which __justifies__ the values selected for evaluation. (152)

11. The discussion of surface water quality impacts of the No Action Alternative and the Development Alternative on p. 140-142 omits impacts due to subsurface leaching of retorts. The leachates from in-situ retorts eventually discharge into Piceance and Yellow Creeks, degrading downstream quality. This has been discussed and quantified by Fox (1980) and more recently, by Persoff and Fox (1982).





12. The discussion of surface water quality impacts of the No Action Alternative on p. 140 only addresses impacts due to dewatering. The same types of impacts discussed for development alternatives, i.e., construction, mining, processing, etc (p. 140-141) also apply to the No Action Alternative and should be included.

13. The Processing Section on p. 140 states that "retort waters are produced by the combustion of hydrogen and oxygen". This is incorrect. They are produced by the combustion and pyrolysis of organics (kerogen, bitumen).

14. The last sentence on p. 140 should be replaced by: "The high value of 22 barrels of water per barrel of oil was due to groundwater inflow at an undewatered site and is not realistic for commercial production. In general, water production rates are higher for in-situ processes than for surface processes due to the use of steam during retorting."

15. The bulleted material in the first paragraph on p. 141 should be expanded to include the item "- initial water content (water is added for dust control and to facilitate compaction)".

16. The phrase "characteristics of " should be deleted from the first sentence in the section, Leachates from Surface Disposal Piles, p. 141. The last sentence in the first paragraph of this section should be modified to read: "Some of the minor components in spent shale leachates can be toxic to plants, animals, and humans and include lead, fluoride, lithium, boron, molybdenum, phenols, and organonitrogen compounds." Arsenic should be deleted from this list because it occurs at low concentrations in leachates. (2)

17. The first complete sentence in the second column on p. 141 should be modified to read: "Permeability factors estimated for the Paraho and TOSCO processes at maximum applied stress __(800 psi)__ vary from 0.26 ft/yr to 0.48 ft/yr.

18. The section, Runoff from Surface Disposal Piles, p. 141, starts with a discussion of __runoff__ from a pile and concludes that __percolation__ may be a controllable problem. The entire discussion, except the first sentence, relates only to percolation. The first sentence should be deleted and the sectin heading revised to read: "Percolation through Surface Disposal Piles". A section should be added on surface runoff (see Margheim, 1975).

19. The discussion of methods to mitigate the impact of pile leachates on p. 141, second column, second complete paragraph, pertains to in-situ retorts, not surface retorts. These types of controls are not technically nor economically feasible for surface retorts, and they should not be recommended in this EIS. For example, surface retorts operate in the temperature range of 500 to 750 C. The formation of relatively insoluble silicates

42

only occurs at temperatures of 900 to 1000 C. Achieving these temperatures in existing surface processes would require extensive redesign and adversely affect oil yield, net energy balance, and process economics. High temperatures are readily achieved in in-situ retorts because they are adiabatically contained by raw oil shale underground.

20. The recommendations on process water disposal in the third paragraph under Mitigation on p. 141 are inappropriate. First, water quality control technologies developed by the oil refining industry cannot be readily applied to oil shale process waters. The information referenced in Crawford et al. (1977) is very out of date. The recent literature is full of refenences to unsuccessful attempts to apply these technologies to oil shale process waters. This has been discussed by Fox et al. (1981). Second, it is inappropriate to recommend final disposition by evaporation or incorporation into retorted shale. Many of these waste waters (i.e., retort water, gas condensates, refinery sour water) have high concentrations of volatile organics which would be released into the air if the waters are evaporated or codisposed. Many of these organics (i.e., nitriles) are highly toxic, carcinogenic, etc. Contaminants in waters added to the shale may be leached from the piles and eventually reach receiving waters by runoff or percolation. This impact would be most severe during pile construction. As a minimum, waters disposed of by evaporation or codisposal must be steam stripped and treated to remove significant quantities of organics and inorganics. Technology has not been demonstrated even at the bench-scale which is capable of achieving this.



43

September 21, 1982

Garfield County Citizens Association
P.O. Box 604
Glenwood Springs, Co. 81602

Oil Shale Projects Team Leader
BLM, White River Resource Area
P.O. Box 928
Meeker, Co. 81641

Dear Sirs:

The Garfield County Citizens Association (GCCA) would like to take this opportunity to respond to the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program.

Our first observation is that a move towards additional leasing at this time is very ill-advised for a number of reasons. The oil shale industry in general is presently, and according to most observers will continue to be for a number of years, in a stationary if not declining position. It certainly does not make sense anyway one looks at it to offer additional leases at a time when project after project is shutting down or cutting back. The two existing federal leases in Colorado are prime examples. The shut-down of the Colony project as well as the reluctance of Union Oil to make a definite committment towards expansion of their facility are further examples.

Upon examination of the companies which have expressed positive interest in additional leasing, we are forced to conclude that none of them have the necessary resources to undertake the massive front-end investments necessary to bring an oil shale project to fruition, or to operate such a facility until the market for shale-oil is restored and absorb the necessary losses until such time. Sure, a lot of companies would like to be able to control large tracts of Federal land. It is made even easier for them due to the present low demand for additional leasing because the bonus bids necessary to gain control of such tracts of land becomes very small. Consequently, less money is available to local governments for impact mitigation, companies which lack the resources to adequately develop the tracts are given control over large portions of Federal land which they hold for largely speculative purposes, and the local economy is subject to another virtually predictable boom-bust cycle which few of us can ill-afford.

As regards the specifics of the DES, we must disagree with the choice of the preferred alternative for the above reasons. Rather, the GCCA supports the No Action Alternative in which no additional federal leases are issued until a proven need for them exists and the companies proposing such leases can document and insure they will be able to bring such a project to fruition. This involves their documenting that their technology has a high probability of success, is economically feasible and that they will continue to operate the project once the feasibility is demonstrated by actual production. Only in this way will local governments and residents have some assurance they will not be subjected to the devastating boom bust cycle once again.

363

**43**

These are the only circumstances in which the GCCA could support additional leasing of oil shale tracts provided other concerns we have relating to social, economic, environmental and health issues are adequately mitigated. In such a case we would prefer that such a lease be a multi-mineral lease. A multi-mineral lease is preferable because production of more than just shale oil would further insure economic feasibility of the project over a period of time, such that even if the market for shale oil declines, production of other minerals could make it economically feasible to continue with the project.

We must also take exception to the Baseline figures which were used to analyze social and economic impacts as they include the now defunct Colony project and the LaSal pipeline project. The DES deals with this by stating on page 18 "...it is not unreasonable to expect these projects or similar ones to come on line in the future." In fact, it is extremely unreasonable to expect these or similar projects to come on line in the future. The inclusion of Colony or a similar project to come on line in the future completely obscures the socio-economic impacts of the proposed leasing of two more prototype leases. (4) Although, by subtracting the Colony project the total impact is lessened, it also makes the impact of leasing two additional lease tracts that much greater. That is to say, impacts that will be experienced will be more directly attributable to leasing Federal lands rather than spread out among a number of other ongoing projects. This makes the Federal decision and the alternative selected in the DES that much more crucial.

To reiterate once again, the proposal to lease additional lands for oil shale development at this time, given current and projected demand and markets for oil products in general and shale oil in particular is extremely ill-advised from both a national policy standpoint and a local residents standpoint. The people of Garfield County simply cannot afford another short-lived boom by an under-capitalized speculative shale project with little or no current or projected future demand for its products. Such a short-lived boom will be followed by a devastating bust of the type we have just gone through, the repercussions of which are still being felt by those of us who make Garfield County our home.

The Garfield County Citizens Association supports the No Action alternative and firmly believes the DES is flawed in that its Baseline data is no longer relevant and that absolutely no ability to follow through on actual development and ultimate production has been shown by the companies seeking additional leases.

Thank-you for your consideration of our comments.

Sincerely,

Michael L. Siegel,
Member of the Steering Committee of the
Garfield County Citizens Association

**44**

# Rocky Mountain Oil & Gas Association, Inc.

COMMITTEE ON OIL SHALE

September 20, 1982

Mr. John Singlaub, Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, CO 81641

Dear Mr. Singlaub:

The Rocky Mountain Oil and Gas Association (RMOGA), through its Committee on Oil Shale, appreciates the opportunity to comment on the Draft Supplemental Environmental Impact Statement (DEIS) for the Prototype Oil Shale Leasing Program (47 FR 31080, July 16, 1982).

Our comments are limited to our primary concerns with the air quality, hydrology and socioeconomic segments of the DEIS as presented below. These comments identify significant inadequacies in the data and evaluations presented in the DEIS. It is our understanding that the associated EIS for the long-term oil shale leasing program is being prepared at this time and that this Programmatic EIS will use much the same baseline information, assumptions, and evaluation methods as does the Prototype Program EIS. We believe that the general comments provided herein, as well as more detailed comments to be submitted by RMOGA member companies, are applicable to both EIS development activities.

## Air Quality

The inadequacies in the air quality evaluation generally use unrealistic modeling approaches. The wind field model, used as the primary input to the air dispersion model, has been validated in a flat terrain (San Diego), but not in the complex terrain of the oil shale region. The model thus produces theoretical input; the data are a projection and are not verified. One result is an unsubstantiated zone of convergence in the Rifle area, leading to unrealistically high concentrations of several air quality constituents. (33) (34) (144)

The air quality modeling further includes overly conservative assumptions with regard to the persistence of stable winds. Other modeling by SAI (DEIS on Uinta Basin Synfuels Development for BLM) uses a "D" stability class, whereas, the Prototype EIS analysis uses an unrealistic "E" class. Considering the existing diurnal variations observed in the Piceance Basin, such stable (Class E) conditions would enhance the existing easterly nocturnal drainage flows, further mitigating impacts on Class I areas such as the Flat Tops. The modeling included in the DEIS does not account for these drainage flows. (80)

345 PETROLEUM BLDG. • DENVER, CO 80202 • 303/534-826'

44

Mr. John Singlaub
September 20, 1982
Page Two

The errors and uncertainties inherent in air quality modeling are not adequately addressed in the DEIS analysis. A better perspective for interpretation and decision-making would be provided by presentation of ranges of likely results rather than consideration of singular data point projections. (32) (82)

The DEIS should limit its consideration of increment consumption. The general weakness in modeling capabilities should be noted in the DEIS evaluation. We believe it is important to point out for the benefit of all, impacts on PSD increments are "consumptions" of the increment to some degree. This "consumption" estimate is dealt within the permitting process, as would be any predicted exceedance. The PSD process should not imply "violation" of or even be directly related to public health standards. (60)

The visibility analysis presented in the DEIS is extremely conservative and should be considered only as a coarse screening procedure. A recent study of visibility models by ERT for the American Petroleum Institute showed that present methods yield predictions which are essentially unrelated to measured values. Using common methods, visibility predictions may differ by a factor of four or more. Thus, the development and validation of suitable and scientifically valid models for prediction of visibility impairment (as well as demonstration of monitoring methods) is needed before such analyses can be used for decision-making purposes. Given this and the poor understanding of visibility impairment mechnisms, this section of the DEIS is inappropriate for decision-making purposes. (140)

The suspended particulates (TSP), in particular as it relates to fugitive dust, is overly conservative. It should be noted in the DEIS evaluation that violations of TSP presently occur under natural conditions. Additionally, because of particle size considerations, fugitive dust is a policy issue much more than a health issue. (86)

Projections of acid deposition are presented in the DEIS without adequate substantiation or interpretation. Modeling capabilities for these projections are not well developed. It should be noted that the SAI analysis for the Utah EIS concludes that acid deposition is not a significant impact. (9)

Socioeconomics

The socioeconomic evaluation is superficial and unsupported in the DEIS with data or analysis. It is unclear what analytical tools commonly used for such analysis have been employed. The evaluation is qualitative and unsubstantiated and may be misleading. (36) (130)

44

Mr. John Singlaub
September 20, 1982
Page Three

The implications and possibilities of negative impacts are discussed. However, no empirical data and no defined methodology is provided to support what are apparently speculative conclusions.

In addition, the DEIS discussion of socioeconomic issues does not account for planned growth or related mitigation measures, and such measures have been developed and implemented. Certain positive benefits and developments such as increased tax base, jobs, etc. are also incompletely addressed or ignored in the DEIS. (124)

Hydrology

The uncertainties in modeling the complex hydrologic systems in the Piceance Basin need to be addressed in more detail in the DEIS. The models employed are largely unvalidated. Use should be made of the extensive data bases, including that on dewatering operations, which exist to substantiate the projections of these models. As presented above on air quality models, the need exists to deal with modeling uncertainties in a manner to provide a realistic perspective for interpretation and decision making. (135)

Thus, in the above three areas the Committee on Oil Shale believes that the DEIS modeling efforts need to be reconsidered. When results are presented in the final EIS they should be qualified to acknowledge the use of unvalidated models and preferrably ranges should be given to indicate the degree of uncertainty in the predictions.

Again, RMOGA appreciates the opportunity to comment. If questions arise concerning our comments, please contact me.

Sincerely,

Pam Oldham

Pam Oldham
Director
Committee on Oil Shale

BS;pss

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
RESTON, VA. 22091

In Reply Refer To:
MMS-Mail Stop 650

16 SEP 1982

Memorandum

To: John Singlaub, Team Leader, Bureau of Land Management
White River Resource Area
Meeker, Colorado

From: Acting Associate Director, Onshore Minerals Operations

Subject: Review of Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program

The Minerals Management Service (MMS) has reviewed the subject environmental impact statement (EIS) both in the field and headquarters. Our comments follow.

General Comments

The supplemental EIS for additional prototype oil shale leasing represents a sincere and thorough effort to compile a wealth of information into an information decision support document. The Bureau of Land Management (BLM) is to be commended for the thought and effort that have gone into compilation, modeling, and evaluation necessary to prepare this document. Their effort to seek out and use information gained by various agencies over the past three-quarters of a decade of oil shale development should also be noted. However, a number of conclusions and observations presented in the supplemental EIS cannot be substantiated based on experience gained from the prototype program to date. This is particularly evident in the discussion of air quality, hydrology, reclamation, and resource recovery. This office would encourage BLM to have their technical representatives for these aspects meet with the staff of our Oil Shale Office in Grand Junction to carefully review related portions of the EIS prior to compiling the final document.

During editing of the final EIS, BLM is strongly urged to delete reference to the Colony Project, which has now been indefinitely suspended, and to the Multi Mineral Corporation's sodium mine, which is no longer an identifiable project now that the operating agreement with Industrial Resources, Inc. (the sodium lessee), has been terminated. BLM should also be urged to indicate which models were used to make predictions about air quality and hydrologic impacts, and to identify the source of the data bases used in model runs. The results of these modeling runs will impact future resource leasing in the basin far beyond the two tracts of concern in this document. The fact that the lessee-required detailed development plan in reality is the National Environmental Policy Act (NEPA) process extended into actual site planning needs to be more







fully explained early in the document. Finally, a number of conclusions are stated in very positive language (will and would), when actual experience with management of the prototype program indicated there is, in fact, a great deal of latitude in perceived impacts more befitting statements couched in "may" or "could."

Specific Comments

Page i, paragraph 2, line 6. We suggest stating that these tracts will be leased specifically and only for multiproduct production (oil shale and sodium minerals). (27)

Page i, paragraph 2, line 10. The statement that leasing C-16 would have "marginally" fewer impacts may detract from the true decisionmaking value of this document by "loading" the conclusion. (62)

Page 3, column 1, paragraph 3, lines 19-20. In order to provide the Government and the lessee with the greatest postlease latitude to use new and innovative methods that maximize resource recovery while minimizing or controlling impacts, stress that development scenarios other than the generalized ones presented in this EIS might also be applicable to these tracts.

Page 3, column 1, paragraph 4. Any of the generalized methodologies could also be used to recover shale oil and gas from the upper portion of the Mahogany Zone. True in-situ methods might also be used to produce oil and gas from the naturally brecciated Leached Zone, as was being evaluated by Equity Oil Company in the Piceance Basin under Department of Energy contract. (19)

Page 3, column 2, paragraph 3, lines 7-8. It can be argued that any further leasing of oil shale tracts would be premature until after BLM has completed the White River Resource Area Resource Management Plan (RMP). This approach, however, would only delay obtaining actual development and environmental management experience under the stringent terms and safeguards of the prototype program essential to administration of any full-scale production oriented permanent leasing program.

Page 4, column 1, paragraph 4, lines 12-16. It is misleading to compare an actual standard to a predicted 24-hour average, as it will falsely magnify the excess (in this case, some 41 times). (83)

Page 4, column 2, paragraph 4, table. Round all dawsonite values to the same number of significant figures right of the decimal point. (6)

Page 4, column 2, paragraph 4, line 8. Intuitively, it would be more accurate to state that "better than 20 percent of the total oil shale resource beneath these tracts could be recovered. This approaches the first pass efficiency of production from many conventional oil and gas fields. Improvements in existing technologies that can come only from actual experience, as well as development of new methods, could . . . ." (162)

Page 6, figures S-2, S-3, and S-4. Actual work force and population figures coming out of the White River and Union oil shale projects suggest that direct labor requirements can be readily reduced by as much as one-third over estimates made public to date. Due to the required 1 to 2 years of predevelopment lease-required environmental baseline data acquisition, population buildup will not follow the depicted straight line path, but will be concave curves both toward and away from the peak construction point. It is also unrealistic to assume, if both tracts are leased, that their respective work force requirements will peak at the same time. There will also be a great deal of "shared" labor between tracts, further reducing actual population buildup. It is also highly questionable whether regional population for the "no action" scenario would peak in 1988 contemporaneous with the preceived maximum labor point should tracts C-11 or C-18 actually be leased. In fact, the "hard" form of these tables suggests a level of predictive knowledge that may not be supportable. (2)

Page 9, column 1, paragraph 1. The reclamation assumptions made in this paragraph are not supportable. Natural gulches used for processed shale disposal will probably be filled to or above the existing ridge line, significantly diminishing the influence of the existing natural drainage slope and aspect. Experience on the existing prototype oil shale tracts suggests that predictions of availability of "soil-like" material based on apparent slope and aspect can be very misleading, with generally more "soil-like" material being found than anticipated. (163)

Page 9, column 1, paragraph 5, lines 7-10. The assumption that development of sodium minerals would proceed independently on C-11 as opposed to simultaneously on C-18 because of the existing sodium lease on the latter, flies in the face of sound mining engineering and resource recovery as broadly described in the three generalized development scenarios. It is reasonable to assume that the successful bidder on C-18 will acquire, in some manner, an operating agreement with the sodium lessee to coproduce both resources. (155)

Page 9, column 1, paragraph 6, lines 1-4. The position that "significant" air quality deterioration will occur under the "no action" alternative is unsupportable, because there is no guarantee that development of private oil shale holdings in the southern part of the basin will proceed with any more certainty or diligence than the existing prototype tracts. Furthermore, the entire paragraph is written in a manner which may easily be misinterpreted. (25)

Page 9, column 2, paragraph 1, lines 1-2. Meteorological evaluation on the existing prototype oil shale tracts in Colorado indicates strong diurnal/topographic air drainage patterns. Thus, C-11 would tend to drain to Ryan Gulch, while C-18 could back into both Ryan Gulch and Yellow Creek. Thus, it can be argued that the severity of air quality impacts related to either tract should not be significantly different. (164)

Page 9, column 2, paragraph 2, lines 3-4. The assumption that mine dewatering on C-11/C-18 will have the worst possible hydrologic impact cannot be substantiated. It is apparently based on the assumption that vertical groundwater communication was well developed along various structural features. Hydrologic testing on tracts C-a and C-b indicates this not to be the case. The system is (88)



highly complex, consisting of numerous "wedding cake" layers of varying vertical and horizontal transmissivity. Rich oil shale intervals, such as the Four Senator's Zone and the Mahogany Zone, tend to form competent aquitards that may virtually isolate mine dewatering effects from the upper zone aquifers that support most of the base flow in Piceance and Yellow Creeks. Both the Golder Report and U.S. Geological Survey Professional Paper 908 are dated and based on assumptions that are not fully supported by more recent field data.

Page 9, column 2, paragraph 3, line 9. "Hydrogen carbonate" should be "bicarbonate."

Page 9, column 2, paragraph 4, line 8. The Mahogany Zone is not totally "impermeable." (2)

Page 9, column 2, paragraph 5, lines 3-4. How was the value of 4 percent flow reduction derived? (109)

Page 9, column 2, paragraph 5, lines 8-9. Piceance Creek already experiences periods of "no flow" due to agricultural diversion with no oil shale industry to speak of, making demands on or significantly dewatering the ground water system. (165)

Page 9, column 2, paragraph 5, line 12. The perceived problem of "no surface flow" could also be realistically mitigated by controlled release of water back into the creek from surface reservoirs or pumping projects on the White River. It is felt that the modeling results summarized in this paragraph are overly pessimistic. (252)

Page 10, column 1, paragraph 3, line 6. What is meant by "subtracting their incremental contribution"?

Page 10, column 2, paragraph 1, lines 11-13. Ultimately, alternate forms of transportation will be required, but initial product transportation could be handled over the existing highway system. (2)

Page 10, column 2, paragraph 1, line 16. Alternative means of product transportation, other than by truck, should be evaluated. (166)

Page 13, column 1, paragraph 4, line 2. What is meant by "high quality" when referring to oil shale? There are many oil shale deposits in the world that are richer than those occurring in the Piceance Basin.

Page 13, column 2, paragraph 4, lines 3-4. It would be more correct to state that the six lease sites in 1973 offered industry an opportunity to use differing technologies due to the variations in the geotechnical settings. (167)

Page 14, column 1, paragraph 1, lines 2-3. Development on the Utah tracts was not "postponed," but delayed by litigation beyond the lessee's control. (155)

Page 14, column 1, paragraph 4, lines 4-6. Excessively fractured ground had little to do with the decision to seek an alternative resource recovery method on C-b. Room-and-pillar mining would have only recovered less than 50 percent (149)

of the Mahogany Zone, leaving several hundred feet of quality resource unproduced due to limits in room size dictated by any mining under 1,200 feet of overburden. Modified in-situ simply provides a way to recover a portion of the shale oil remaining in sill pillars that would have been left between the various mine levels.

Page 14, column 2, paragraph 2, lines 7-9. It should be stressed that the leasing action will require development in a manner that achieves multiproduct production. (27)

Page 16, column 1, paragraph 6, lines 6-10. This sentence implies that an EIS/environmental assessment (EA) would be required prior to approval of a detailed development plan. This is not the case, although the MMS Oil Shale Office prepares a publically available decision document. (165)

Page 16, column 2, paragraph 2, lines 7-8. Approval of the baseline environmental program and the detailed development plan need only come from the appropriate official within the MMS. In the past, it has been the policy of the Deputy Minerals Manager for Oil Shale to seek Departmental concurrence for approvals of original development plans; thereafter, technical revisions have been handled solely at the field level. (164)

Page 16, column 2, paragraph 2, line 17. Public hearings on lease-required plans are conducted by the MMS on behalf of the Department. (155)

Page 16, column 2, paragraph 2, line 22. BLM concurrence in plan approval is usually sought for original development plans. Subsequent technical modifications do not require such concurrence, although it has been the policy of our Oil Shale Office to discuss major modifications with BLM before taking final action.

Page 18, column 1, paragraph 9, lines 3-5. Unfortunately, the energy alternatives developed for the 1973 EIS may no longer be valid due to the increased emphasis on conservation, biomass, solar energy, and the like. (8)

Page 19, column 1, paragraph 5, line 1. It should be stated that there are methods whereby raptor pests can be "taken" or moved so as not to unrealistically impede development.

Page 19, column 1, paragraph 6. It would be more meaningful to the reader if the affected tract were identified in the legal description here and after item 4. Why are these protected nesting zones on tract C-11 when the only identified raptor nest discussed in this EIS is on tract C-18? (97)

Page 23, column 1, paragraph 1, lines 7-11. With regard to the expressions of interest, the use of the term "offered" seems inappropriate since sites were not offered by either industry or Government, but suggested by industry to the BLM for possible leasing consideration. (164)



Page 23, columns 1 and 2, paragraph 4, lines 2-3. It should be emphasized that the generalized development scenarios are by no means the only methods that might ultimately be used in C-11 and C-18. They are intended only to give the decisionmaker a general impression of the types of activities and impacts that might arise from leasing and development of either tract. (19)

Page 23, column 2, paragraph 5, lines 1-2. At the moment, the most important nonagricultural activity in the Piceance Basin is oil and gas production. True, sites have been leased for oil shale and sodium mineral production, but as of yet, commercial operations at these lease sites have not been achieved. Therefore, oil and gas production should be discussed first. (168)

Page 24, column 1, paragraph 2, lines 11, 14, and 18. Off-tract areas would be needed for the initial 30 to 40 years of overburden and processed shale disposal derived from an open pit operation of tract C-a. Thereafter, all wastes could be safely backfilled into mined out portions of the pit. The statement that "uncertainties" underlie the economics of an open pit operation may not be entirely true. Finally, a small noncommercial scale pit could be opened on tract C-a without the need for off-site disposal. Such an approach, however, might reduce the amount of oil shale that could be recovered from that portion of the tract used for waste disposal. (155)

Page 24, column 1, paragraph 3, lines 8-9. The 30-year production life applies to which production rate scenario?

Page 24, column 1, paragraph 4, lines 3 and 6. The scaling factors for a 50,000 barrel per day (bbl/d) open pit operation on tract C-a are somewhat misleading. A 50,000 bbl/d Lurgi surface retorting complex feed from an open pit would probably require as much as 14,000 acre feet/year (af/y) of water. Requirements for mining would be insignificant. A 100,000 bbl/d operation might require a third more water, as there are certain economics of scale. Aerial disturbance cannot be tied to production rate. Whether producing 50,000 or 100,000 bbl/d, it should be assumed that all the exploitable resources beneath the tract will ultimately be produced, less that portion left under the sloping pit wall which might be partially recovered by mine workings drifted in from the pit. The only variable would be the total life of the operation. Nevertheless, a 50,000 bbl/d operation could be carried out on tract C-a for nearly 40 years and only affect 750 acres for the pit while requiring 3,650 acres for off-site waste disposal. (164)

Page 24, column 2, paragraph 2, line 3. It is not a supportable assumption that the future work force will distribute itself similar to employee residence patterns experienced in tract C-a. If the county road now under construction to Rangely is completed, it can be assumed that a majority of the employees from tract C-a will live there due to the shorter commuting distance. (38)

Page 24, column 2, paragraph 4, line 5. The development schedule assumed for tract C-b should be revised. The recently approved Interim Development Schedule calls for commencement of renewed mine development in 1984, followed by surface construction in 1985, with the work force probably peaking in about 5 years. (4)

Page 24, column 2, paragraphs 5 and 6, line 3. Estimated water requirements are probably excessive. For 21,000 bbl/d, water needs would probably be more on the order of 4,000 af/y and about 8,000 af/y for 72,000 bbl/d of production. Again, regardless of the production rate, in time all of the mineable acreage of the tract will be affected (defined for C-b as the leased acreage, less boundary and mine pillars). The only variable would be the area needed for surface facilities and the operating life of the tract. (164)

Page 25, figure II-1. The map does not show the second 40-acre parcel in the SE 1/4 of section 29, T. 1 S., R. 97 W., across Horse Draw. (169)

Page 26. These figures should be referred to in the text, or their value to the document is questioned.

Page 27, column 1, paragraph 10, lines 1-3. It should be stated that Multi Mineral Corporation recently terminated their operating agreement with Industrial Resources, Inc., for the right to develop the sodium resources beneath tract C-18. Thus, while they have a valid mining plan, Multi Mineral Corporation may not be able to implement it. (4)

Page 28, column 2, paragraph 6. Results of air quality modeling are highly argumentative and should be so stated so as not to lend undue weight to the values presented. To be usable in making reasonable estimates of impacts, modeling results should be presented in table form and for 1- to 2-year increments. It should also be noted that each project is on a different development schedule resulting in wide variation in emission quantities. BLM is urged to contact the air quality specialist at our Oil Shale Office for assistance in evaluating modeling results. (32) (145)

Pages 29-32. To be of value, the approximate area of disturbance depicted in each picture should be stated relative to the total area of the photo. Reference to an appropraite map indexing the photo sites should be given.

Page 32, column 2, paragraph 1, lines 10-14. If the ground water regime will eventually reestablish itself, then it is reasonable to assume that some of the springs and seeps will reestablish themselves.

Page 33, column 1, paragraph 3. Virtually all of the affected oil and gas unit agreements contain stipulations that the oil shale resources must be protected. Language is now inserted into all approved Applications for Permits to Drill (APD's) within the Green River Formation geographic area requiring the oil and gas lessee to plug wells at the time the oil shale developer needs mining through them. Thus, the magnitude of temporary oil shale production loss stated in this paragraph seems overstated. (170)

Page 33, column 1, paragraph 7. This section on soils indicates that soil losses depend upon the degree of reclamation success. However, this conflicts with the paragraph on vegetation, on this same page, in that the latter paragraph states categorically that the loss of 1,500 animal unit months (AUM's) of forage is temporary--"until disturbed areas are adequately reclaimed." Reclamation of (171)







100 percent of these AUM's is by no means a certainty, as is clearly indicated elsewhere in the EIS. It is suggested that this paragraph be changed to reflect the uncertainties associated with reclamation of the vegetation systems at this time.

Page 33, column 2, paragraph 4. Under the "no action" alternative, development of tracts C-a and C-b is assumed based on previous discussion. Thus, there will be a recreational displacement effect at these sites, as well as at the sodium lease site. (164)

Page 34, column 2, paragraph 1, line 9. Replace the dash in "NW-NE" with a slash "NW/NE" to imply the two major joint sets. (6)

Page 34, column 2, paragraph 3. What would be the incremental additions to air pollution emissions from tract C-11, and how much earlier (when) would modeling predict violation of PSD standards? (2)

Page 34, column 2, paragraph 5, line 7. Oil shale resources will also be lost to required boundary pillars. (164)

Page 35, column 1, paragraph 1, lines 3-8. For direct mining, resource recovery/loss figures do not agree with values on page 63, column 2, paragraph 6. (2)

Page 35, column 1, paragraph 1, lines 2-20. The manner in which possible resource losses relative to various development scenarios is presented in highly speculative and should be so stated. Results of recent MIS tests on tract C-a suggest recovery efficiencies of up to 68 percent within the rubbled column, making it nearly as efficient as room-and-pillar mining on paper. Efficiencies for "true in-situ" is anyone's guess and probably ought to be handled simply by stating that it would be somewhat less than for MIS. True in-situ method might work under certain conditions even better than direct mining for recovery of soluble sodium minerals over a thick column of resource. Finally, the picture painted by these numbers is so dismal that one wonders if any leasing should occur. (164)

Page 35, column 2, paragraph 1, line 4. "Agricultural land" must be contextually defined. It is probably used here to define marginal irrigated hay lands and upland range grazing lands. (172)

Page 35, column 2, paragraph 3, lines 11-13. The statement about soil impacts does not agree with values in table IV-7, page 129. (155)

Page 35, column 2, paragraph 3, lines 1-18. The observation made about leasing causing soil damage is misleading, because the described erosive conditions already exist. Development of the tract will, if anything, eliminate large areas susceptible to erosion by filling in gulched areas with mine and process wastes, eliminating them as natural erosion channels.

Page 35, column 2, paragraph 4. The modeling inefficiencies admitted to in paragraph 5 are obviously gross, including the assertion that reinjection of excess mine water would not be practicable. Poor quality water could be readily reinjected into the lower aquifer in the leached zone where ground water is (164)

already of poor quality. Other development plans reviewed by this office describe a high degree of water conservation through recycling. Thus, only a very small amount of highly polluted process water would have to be dealt with, probably by evaporation in lined ponds. It should also be pointed out that virtually all site water requirements would be met by using mine pumpage, which well exceeds the 8,000 af/y stated as being needed.

Page 36, column 1, paragraph 2, lines 3-5. In the business of environmental management, nothing can be "prevented"--it can be controlled. Monitoring does not of itself "control" anything either, but it can be used to quantify and regulate. (2)

Page 36, column 1, paragraph 4, lines 8-9. Direct mining and modified in-situ have virtually identical impacts on the surface in terms of area required for support facilities and waste disposal. True in-situ may be 'ittle better in this respect due to surface preparation requirements for the numerous closely spaced boreholes. (11)

Page 36, column 1, paragraph 7, line 2. The number of deer kills due to vehicular accidents will not be appreciably different on C-11 or C-18, because access routes to the two tracts are largely identical. Actual tract development results only in displacement of resident deer through removal of grazing/bedding habitat. There have been no reports to date of deer being killed on either tract C-a or C-b by construction equipment. Habitat mitigation measures should largely offset loss of grazing land. It can also be argued that tract development may tend to reduce deer loss, as hunting around the developments sites will be discouraged. Experience on the existing tracts also suggests that the deer do not shy away from construction activities once they perceive that there is no direct threat to their safety. (12)

Page 37, column 1, paragraph 2. The paragraph on transportation does not address employee transportation to and from the tract. (173)

Page 37, column 1, paragraph 3. The assumption drawn about transportation impacts relative to method of development cannot be substantiated. A great deal will have to do with the type and form in which products are shipped, market mix, and the like. Recovery efficiencies will play an insignificant role as actual production rates will be set at the maximum the market will bear. (149)

Page 37, column 1, paragraphs 5-10. Unless substantiated elsewhere in this EIS, these paragraphs contain largely unsupportable statements. (164)

Page 37, column 2. Comments above for the discussion of "Alternative C-11" also apply to the discussion of C-18. The discussion of soils is equally poor in that once development occurs, the issue is no longer one of reclaiming the existing terrain, but that resulting from depositing of wastes into natural gulches, which can be done in a manner to achieve virtually any desired slope and aspect that will enhance reclamation. If anything, development of C-11 may have less impact, since the solid regime is less well developed and supports sparser vegetative community than on C-18. Thus, any alteration in aspect would benefit productivity. (163)



Page 38, column 1, paragraph 1, lines 5-10. Resource loss figures do not agree with recovery values given on page 64. (2)

Page 39, column 1, paragraph 5, lines 2-4. The assumption that development of both tracts will result in doubling of the impact fails to appreciate that, with two operations in close proximity of one another, there will be a tendency to share facilities such as transportation systems. There will also be a tendency for the work force to move among the sites as a particular skill is needed, thus the total population's growth will be as much as a third less than the simple sum derived from each site. (164)

Page 39, column 1, paragraph 8, lines 4-9. Values for total estimated nahcolite and dawsonite resources do not agree with those given in the table on page 4. (2)

Page 41, column 1, paragraph 3, lines 13-15. Headframes may not be of the concrete design used on tract C-b, and the size of the retort facilities will depend on the desired rate of production and required ancillary equipment. (164)

Page 41, column 2, paragraph 1, lines 9 and 10. Since the terms "directly" and "indirectly" have not been previously defined, it is suggested that they be taken out and the sentence made to read: "These rubble filled chambers are then heated at the top with special burners or externally heated gases and supplied with air and steam to initiate, sustain, and control the rate of combustion to retort out the kerogen."

Page 41, column 2, paragraph 2, line 4. These lines would more accurately read ". . . and crush the oil shale to uniform size underground." Delete "to ship off site." (2)

Page 41, column 2, paragraph 3, lines 1-5 and 7. As previously stated, direct mining and MIS have nearly the same surface disturbance requirements. While MIS may not have associated surface retorts, the facilities needed to handle and scrub the large volumes of off-gas will probably take up as much space as a surface retort train. Delete the word "again" in line 5, as it suggests a not entirely correct inference. Delete "less than" beginning in line 7, as it does not agree with table IV-11 on page 143.

Pages 41 and 41. The discussion of true in-situ would be more appropriate if the reference to dissolving away remaining nahcolite was removed. Heating can also be achieved by direct combustion, as well as by circulating some type of heated working medium, which can be a gas as well as water. (164)

Page 45, column 2, paragraph 2. It can be argued that leasing should be delayed until after BLM has completed the White River Resource Area RMP. This, however, would delay obtaining actual development and management experience essential to design and operating a permanent leasing program. (174)

Page 48, Air Quality. Mr. Lee Stevens, of our Oil Shale Office, is available to coordinate reevaluation of this section. He may be reached at FTS 322-0281.

Page 53, table III-2. Are the annual mean sulfur dioxide concentrations for the Rio Blanco tract "26" or 2.6? (156)

Page 60, figure III-4. The east boundary of tract C-11 should be indicated on the cross section.

Pages 63, column 2, paragraph 1, and page 64, column 1, paragraph 2. Use of the term "discrete" in reference to the zonation applied to the Green River Formation is misleading. The difference between zones is often quite subtle. It would be more accurate to delete the term. Furthermore, we are uncertain as to how the number of stratigraphic zones was derived for the two tracts. Again, it would be more accurate to state that there are a number of such zones without specifying the number.

Page 63, column 2, paragraph 4. Values do not agree with those in table IV-5, page 125, with the latter being in error.

Page 63, column 2, paragraphs 5 and 6. Values do not agree with those in column 1 on page 35, with the latter being in error. (2)

Page 64, column 1, paragraph 7. Values do not agree with those in column 1, page 38, or with those shown in table IV-5, page 125, with the latter two being in error.

Page 65, figure III-6. Show the common north/south boundary between C-18 and C-11 on the cross section.

Page 67, column 1, paragraph 2, line 17. This line would more accurately read, ". . . product to the formation, currently rendering . . . ."

Page 67, column 1, paragraph 3, line 1. This line would more accurately read, ". . . near the depositional center . . . ."

Page 72, column 1, paragraph 3, line 7. Insert before "transmissivities" the statement that the indicated value is based on limited data. (156)

Page 72, column 1, paragraph 4, lines 7 and 8. Robson and Saulnier stated in U.S. Geological Survey Professional Paper 1196, page 12, that vertical conductivity is as low as 7 x $10^{-4}$ ft/day. (164)

Page 72, column 2, paragraph 2, line 7. "Recharge" should be "discharge." (2)

Page 72, column 2, paragraph 4, lines 1-3. Since the Mahogany Zone acts as an aquitard to upward movement of the lower aquifer waters, most of the base contribution to stream flow comes from the upper aquifer. (164)

Page 73, table III-9, item 8. "Maximum daily sediment discharge" should be 290,000. This is a record amount often cited in literature.

(2)

Page 76, column 1, paragraph 3, line 8. "90,000 tons" should be changed to "290,000" to be consistent with the indicated change in table III-9.

Page 77, column 1, paragraph 1, line 10. The value of 700 lbs/acre is approximately twice that measured at the existing oil shale tracts in Colorado. For



each of the major vegetation types, the discussion should also include a statement as to utilization. The descriptions would also be more complete if a species list were included. (175)

Page 77, column 1, paragraph 4, line 7. The value of 650 lbs/acre seems much too high based on measurements taken on the existing oil shale lease tracts.

Page 77, column 2, line 2. The value of 200 lbs/acre seems too high based on measurements taken on the existing oil shale lease tracts.

Page 77, column 2, paragraph 4, lines 5-7. On which tract was the threatened milkvetch located? (2)

Page 81, column 1, paragraph 5, lines 1-5. The described location of the raptor nest is not within the two areas suggested for protection on tract C-11. (97)

Page 100, figure III-18. Lease numbers for locations 24 and 25 are not listed (2) in the index. Locations of any active or abandoned wells should be shown, as well as any applicable unit boundaries. (167)

Page 101, column 1, paragraph 3, line 1. Insert "and associated minerals" after "Processing of shale." (2)

Page 101, column 2, paragraph 2, lines 9-11. The need for surface disposal is far more complex than the result of simple mechanical swell of the oil shale from crushing. Mine voids usually cannot be filled to full height. Certain mine workings would probably never be filled due to their continued use as haulage ways. The double handling of materials in and out of the mine might also make it economically prohibitive to move large quantities of waste material back underground. (176)

Page 101, column 2, paragraph 3, line 8. The relationship between failure to obtain compaction of the spent shale and problems with the "natural cementation" is not clear.

Page 101, column 2, paragraph 3, line 1. This sentence is confusing and should be rewritten.

Page 102, column 1, paragraph 1, lines 4-7. Admittedly compactions will increase slope stability. However, slope stabilization can also be achieved by limiting slope angle by establishment of a vegetative cover and by attention to drainage diversion. (164)

Page 102, column 1, paragraph 2, line 4. While it may be possible to construct stable processed shale banks with slope angles as high as 2:1, it is not practical to vegetate slopes of that angle. By keeping slopes 3:1 or less, both bank stability and reclaimability will be enhanced regardless of the degree of compaction.

Page 102, column 1, paragraph 5, line 5. Shale would probably have to be heated well above 900°F to obtain optimum decarbonization and calcination of the carbonate minerals.

Page 103, column 1, paragraph 1. Seepage into and through processed shale disposal piles can be diminished by placing a layer of soil-like material over the waste, as evidenced by results from test site R-3 on tract C-a. (2)

Page 103, column 2, paragraph 2. Experience on the existing oil shale lease tracts suggests that it would be impractical to leach the large volumes of processed shale to reduce pH. At best, the shale can be moistened in the post-retort quench cycle to a level that will enhance pile compaction appreciative of the manner in which the pile will be constructed. Thereafter, the most effective method to minimize leachate production would be to blanket completed portions of the disposal pile with native "soil-like" material to a sufficient depth wherein available moisture (rain and snow) will tend to move only within the artificial soil horizon. A capillary break of coarse material (unretorted shale rubble or native sandstone) would be provided beneath the soil horizon to minimize uptake of salts and to discourage plant root growth into the processed shale beneath. (177)

Page 103, column 2, paragraph 4. It is doubtful that 75 to 85 percent of the processed shale could be placed back into mined out areas, even when considering the saline zone where removal of nahcolite will increase the mine void space available for backstowage of processed shale due to the volume of mine openings that would have to remain open for haulage and ventilation. (93) (176)

Page 104, column 1, paragraph 1. MIS would provide somewhat less space for backstowage than direct mining, because a large portion of the original mine void is bulk filled with shale during the rubblization process to create individual retort chambers. (2)

Page 104, column 1, paragraph 4. It is erroneous to suppose that total surface area disturbance for processed shale disposal could be diminished by piling processed material within those areas used for mine support facilities (hoisting, support buildings, retort areas, etc.). These facilities will be required throughout mine life and for some period thereafter to support mine abandonment activities. We suggest deleting this discussion. (178)

Page 104, column 2, paragraph 5. Suitable plant growth material should not be limited to only fine soil material. Experience on the existing Federal oil shale tracts suggests that even pieces of the flaggy Uinta ragolith can be used to blanket processed shale piles, as it rapidly breaks down into finer material due to natural weathering and mechanical breakage by earthmoving equipment. Even large chunks of material used for the capillary break at test plot P-3 on tract C-a showed considerable physical deterioration after only 3 years of weathering. (155)

Page 105, column 2, paragraph 3, lines 10-12. The recommendation that all processed shale be consolidated to "rock-like" form is both impractical (likely is unachievable) and, based on test plot studies on the existing Federal oil shale tracts, unnecessary. It is recommended that this statement be deleted. (2)

Page 105, column 2, paragraph 4, lines 4-5. It should be stressed throughout this document that the NEPA process does not stop once the EIS is accepted in final form. The lease-required detailed development plan goes far beyond the EIS in describing anticipated site-specific impacts and mitigation measures. Also, like an EIS, it is subject to public review and hearings before final action is taken by the MMS mining supervisor for its approval and implementation. (164)





Pages 109-121. The discussion of the impacts of the proposed project on air quality addresses air quality impacts primarily in terms of visibility impairment, total suspended particulates, CO, $SO_2$ and $NO_x$. The aerial release of trace metal vapors, other metallic complex gases, polyaromatic hydrocarbons (PAH), and other toxic organic compounds known to be associated with the development of oil shale are not addressed. The data base used to develop other oil shale EIS's of a programmatic nature contains significant information on the hazardous byproducts of oil shale development relative to their impacts on workers and the general public. We believe these issues should be addressed in this EIS. Since we understand that these issues are being addressed in other oil shale EIS's currently under development, we suggest that their discussion in this EIS is important from the standpoint of consistency. (141)

We also feel the modeling results need to be carefully reevaluated. We encourage BLM to work with Mr. Lee Stevens, our air quality specialist in the Oil Shale Office, in their reassessment. We question the omission of all possible oil shale development site emissions from the regional modeling runs, as those new source sites included by BLM in modeling suggest that BLM may know more about the timing of these projects than can be currently substantiated. The use of illustrative figures like IV-2 is encouraged.

Page 121, column 2, paragraph 3. While this may not be the appropriate place in this EIS, it should be pointed out that oil and gas development and oil shale mining are not mutually exclusive actions, nor does mining prevent construction overtop mined out areas. Mining and petroleum production proceed together in other parts of the country and are mandated under the multiple resource use management practices of BLM. Virtually all of the unit agreements for oil and gas contain stipulations that require the driller to protect the oil shale resource and to abandon wells at the time the oil shale lessee may need to mine through them. (164)

Page 121, column 2, paragraph 4, lines 8-10. Increases in resource recovery efficiencies are usually attained at a given site after development begins and the ground conditions become more fully known through actual mining experience. Thus, delaying leasing on the assumption that greater resource recovery can be achievable at a later date is not a totally substantiable position.

Page 121, column 2, paragraph 5, lines 1-4. The meaning of this statement is unclear. (179)

Page 122, column 1, paragraph 5, line 10. The statement that current mining and development practices will result in a permanent loss of 80 percent of the estimated resource implies that there would be, over time, no advance in extractive technologies that would allow at least some production from unmined intervals. It is suggested that this inference be deleted. (164)

Page 122, column 2, paragraph 4. It should be pointed out that mining across the breadth of an approximately 8-square mile oil shale tract will take decades, affording adequate time for oil and gas exploration and production to take place on the further reaches of each tract prior to conflicting with shale oil and sodium mineral production. (2)

Page 123, column 2, paragraph 1. Geokinetics reports that true in-situ tests from shallow buried oil shale have reached their recovery efficiencies of as much as 44-50 percent. Efficiencies would drop off rapidly with increasing depth due to reduced ability to create needed permeability. The equity process takes advantage of the natural permeability in the leached zone that resulted from formation brecciation as ground water removed soluble minerals. Superheated steam is circulated between a pattern of well points to break down the kerogen in the shale. To date, success with this process has not been noteworthy, largely due to equipment problems and still poorly understood thermal dynamics of heating the shale in place.

Page 124, column 1, paragraph 4, lines 4-7. While wastage of resource is always a possibility with untried technology, the methodology for efficient oil shale and saline minerals recovery from the Piceance Basin will not be developed without an opportunity to operate directly on the resource. Under the prototype program, there are adequate lease safeguards to enable the MMS to suspend operations at any time that it should become apparent that reasonable resource conservation cannot be attained. (164)

Page 124, column 1, paragraph 4, lines 7-12. Concurrent oil and gas production is already provided under the multiple resource management practices of the BLM. There is no technical reason foreseen at this time that would preclude oil and gas drilling and production either in advance of or subsequent to oil shale and sodium mining. Existing unit agreements require that the oil and gas lessee temporarily plug and abandon any wells at the time the oil shale lessee would need to mine through them. (155)

Page 124, column 1, paragraph 5, lines 4-7. Proper boundary pillar layout and design would preclude off-tract subsidence fracturing of the resource interval irrespective of whether the mine workings were backfilled or not. (164)

Page 124, column 2, paragraph 4. Partly because the Interior Department cannot permit off-site waste disposal without legislative authority, development of tract C-a has been suspended by the MMS appreciative of the far greater resource conservation that would be attained by open pit mining. (167)

Page 125, table IV-5. In order for this table to coincide with figures in chapter II, the column under "direct mining method" should contain the following values:

| | | | |
|---|---|---|---|
| C-11 | 2.59 barrels | .614 tons | .155 tons |
| C-18 | 2.3 barrels | .564 tons | .172 tons |

(2)







Page 127, column 2, paragraphs 2 and 4. The inference that any development of the tracts would "significantly" or "materially" damage the water supply to the alluvial valleys of Ryan or Yellow Creeks appears to be an overstatement of reality based on experience gained from existing tracts C-a and C-b.

Page 128, column 1, paragraph 4. The assumptions made about soils impacts in this paragraph need careful explanation. Properly designed and implemented reclamation would not only largely mitigate loss of soil productivity, but could radically enhance overall forage production and protection of soils from erosion. (164)

Page 128, column 1, paragraph 5. Reclamation research on the existing oil shale tract and elsewhere do show a reduction in stockpiled soil biotic activity in more deeply buried portions of the piles. If soil stockpiles are revegetated, nutritive and microorganism activity is maintained near the pile surface. When surface and more deeply buried material are mixed during reclamation, overall soil biotic activity rapidly reestablishes itself. Thus, the inference made in this paragraph is overstated.

Page 128, column 2, paragraph 2. Again, the implications made in this paragraph are overstated. Tests at the Colony site prove that spent shale can be directly revegetated. Admittedly, a great deal more attention must be paid to leaching down salts and initial irrigation to achieve direct revegetation where the processed material has been blanketed with native soils. Since even coarse material derived from the sandstones of the surface forming, Uinta Formation can be used as a growth medium, the assertion that only about 15 inches of soil material would be available in the disposal area cannot be substantiated as limiting blanketing depths. BLM is urged to contact the range biologist and reclamation specialist at the MMS Oil Shale Office in order to bring the conclusions in the soils section more into reality. (180)

Page 130, figure IV-8. The instantaneous restoration of water level noted in the text and implied by the curve in this figure after pump shutoff is not completely realistic. It would take years for the aquifers to completely recover. (181)

Pages 131-142. The discussion of the impacts of the proposed project on ground and surface water quality omits a discussion of potential water quality degradation and public health impacts relative to the release and leaching of PAH, other toxic organics, and heavy metals such as arsenic and lead. As mentioned above, the oil shale data base contains significant information on the hazardous byproducts of oil shale development relative to their potential impacts on the general public. We understand that these issues relative to water quality are being addressed, or at least mentioned, in oil shale EIS's currently under development and suggest that their mention in this EIS is important from the standpoint of consistency. (2)

Page 131, column 1, paragraph 3. Since reclamation of either tract would afford the opportunity to modify the prevailing aspect, the assumption stated in this paragraph cannot be substantiated. (163)

Page 132, column 2, paragraph 5, lines 9-12. Complete early dewatering of the interval to be mined is neither practical nor required. The advancing mine workings will act as a drainage system, minimizing the requirement for dewatering wells. If attention is paid to maintaining competent roof stone while mining the Mahogany Zone, there may be no need to directly dewater the overlying upper aquifer. Mining below the dissolution surface should encounter dry conditions that can be preserved by sealing the shaft liner into the upper salt beds. Thus, the modeling results described in this section may not represent field conditions encountered during mining.

Page 133, column 1, paragraph 3. This paragraph is misleading. Regardless of the mining rate, dewatering will only be of significant concern in the immediate area of new development. Thereafter, the mine workings will tend to act as their own drainage system. Fully developed portions of the mine can be allowed to rewater, thus limiting the actual area of significant dewatering to the active mine panels. (164)

Page 134, column 1, paragraph 1, line 10. "Hydrogen Carbonate" should be "bicarbonate." (2)

Page 134, column 1, paragraph 2. The inference of this paragraph is that leachate carried by ground water will not be altered chemically over the travel path by interaction with unaffected strata. This will, of course, occur and may significantly reduce the deleterious quality of leachates by the time they reach the surface.

Page 134, column 2, paragraph 7. This paragraph implies that post abandonment monitoring of ground water impacts should be carried out for hundreds of years. (164)

Page 135, figure IV-9. Does the shaded area on this figure reflect dewatering from only C-11 and C-18, or from existing tract C-a as well? (2)

Page 137, column 1, paragraph 2, lines 10-12. Piceance Creek already experiences periods of no flow due to agricultural diversion to irrigate the hay meadows at a time when no significant dewatering is occurring from oil shale development. (165)

Page 137, column 2, paragraph 2, lines 4-5. The fact that the hydrologic model assumed perfect connection between the aquifer and surface water systems should be stated at the beginning of this EIS to place all inferences on hydrologic effect into proper perspective. (164)

Page 138, table IV-10. For Piceance Creek, why is the predicted depletion less for 50,000 bbl/d than for the "no action" alternative?

Page 140, column 2, paragraph 3. It seems contradictory to state that the TDS of Yellow and Piceance Creeks will increase as a result of reduced streamflow attributed to mine dewatering and then to state that the same effect will cause a reduction in salinity in the Colorado River. Further explanation is needed. (2)

Page 149, column 2, paragraph 4, line 6. How was the figure of 36,000 acres of impacted wildlife habitat derived? This equals more than the total leased



acreage for all of the Federal oil shale tracts in the Piceance Basin, including the two proposed for leasing. This figure also seems to fail to take into consideration mitigative actions, such as increasing the carrying capacity of surrounding undisturbed areas as is being done by the lessees of the existing oil shale tracts. (98)

Page 150, column 1, paragraph 1, lines 1-15. Pinyon-juniper, at best, is not a nutritious forage and is usually resorted to by deer only as a last resort when tall standing shrubs are buried by accumulating snow. The statement made here fails to consider that an overstory could be more quickly established by using superior, fast growing nursery stock (tublings) and that only about 4 feet of height is needed to provide adequate cover. Furthermore, attention to terrain contouring during reclamation can be used to provide cover for large mammals in deference to tall standing vegetation.

Page 150, column 1, paragraph 5, lines 1-3. This is the first and only place where the possibility of on-tract housing is discussed. If this is considered to be a likely possibility, further discussion is warranted in chapter IV.

Page 151, column 1, paragraph 3. At best, impacts to the wild horse population should be short term, as it is our understanding that BLM will have the last of them rounded up by 1988. (164)

Page 151, column 1, paragraph 5, line 2. The statement that increase in traffic results in an <u>equal</u> increase in the number of accidents involving wildlife is true to the extent that there is a rough correlation between numbers of vehicles using basin roads and deer road kills. There are many other factors that also affect the number of kills, as the rest of the paragraph indicates. We suggest that the word "equals" be deleted. (2)

Page 141, column 2, paragraph 1, lines 6-9. Employee busing should be discussed in greater detail in the socioeconomic part of the EIS. (182)

Page 152, tables IV-15 and IV-16. It is assumed that "low" and "high" refer to production rates of 25,000 and 50,000 bbl/d, respectively. What is the range of confidence limits on these numbers? (183)

Page 154, column 1, paragraph 2. Initial mine dewatering may make more water available to surface uses. Later, properly designed water management programs should greatly minimize any adverse effects on habitat utilization. (164)

Page 170, column 2, paragraph 5. This paragraph belongs under "Housing" in the preceding column.

Page 171, column 1. This column belongs under the section on housing in the first column on page 170. (2)

Page 179, column 2, paragraph 2. While increased rail traffic to handle oil shale related materials may not significantly affect the existing mainline system, the effect on use of bottomlands along the Colorado River for sidings and storage yards in the Rifle area might be of some size. We suggest that BLM review the product transportation section in the <u>original</u> detailed development plan for tract C-b. (164)

Page 186, column 2, paragraph 7. It should be stressed that, while 1,200 to 6,800 acres might be removed from native vegetation production during the life of the operations, not all of the acreage will be out of production at any one time. In fact, compliance with air quality regulations alone will necessitate concurrent reclamation to achieve compliance with particulate standards. (184)

Page 187, column 1, paragraph 2. There is also a potential, although remote, for loss of wildlife through accumulation of mineral salts in the soils and vegetation that might reach hazardous levels over time. Routine monitoring and attention to waste water disposal practices should assure that the potential for such impact is very low. (164)

Page 189, column 1, paragraph 5. The conclusion reached in the paragraph on geology is contrary to preceding statements in this EIS. At present, probably about 75 percent of the total resource might not be recoverable. Based on the normal learning curve for actual development experience, recovery efficiencies should improve significantly. Modified in-situ currently offers a way to achieve improvements in overall recovery from direct mining by retorting shales that would be left unproduced between the mine levels. To some extent, true in-situ offers the same potential for secondary recovery from well points developed from mined out levels. (2)

Page 190, column 1, paragraph 3. Without an opportunity to attempt commercial production of oil shale, as is afforded by the prototype program under rigid environmental controls, improvements in extractive efficiencies will be further delayed. (164)

Page 192, column 1, paragraph 1. A major shortcoming of this EIS is that pipeline transportation of products is not addressed, nor are likely corridors for pipelines and powerlines. (166)

Page 223, paragraph 3, item 4. This is the same statement that appears in the last half of paragraph 4 on page 220, and it does not need to be repeated.

Page 226, paragraph 9, section 4(A), line 2. This line should read, ". . . exploration plan, a stabilization, and/or revegetation plan for all areas to be disturbed . . . ." (164)

Page 229, paragraph 7, item (D), lines 10 and 11. This should state the design storm for which containment must be provided.

Page 234, paragraph 1, line 2. Reference to "with concurrence of BLM" should be deleted. This is an understood practice pursuant to Secretarial Order 2948.

If you have any questions concerning our comments, please contact Mr. Eric Hoffman, of our Oil Shale Office, on FTS 322-0281. Thank you for the opportunity to comment on this document.

Ervin R. Wyatt
for Andrew V. Bailey

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STATE OF COLORADO RICHARD D. LAMM, Governor

**DEPARTMENT OF NATURAL RESOURCES**

D. MONTE PASCOE, Executive Director
1313 Sherman St., Room 718, Denver, Colorado 80203 866-3311

Geological Survey
Board of Land Commissioners
Mined Land Reclamation
Division of Mines
Oil and Gas Conservation Commission
Division of Parks & Outdoor Recreation
Soil Conservation Board
Water Conservation Board
Division of Water Resources
Division of Wildlife

September 16, 1982

Mr. John Singlaub
Oil Shale Project Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Meeker, Colorado 81641

Dear Mr. Singlaub:

For some time, the State of Colorado has supported the offering of a multi-mineral lease in the Piceance Basin. We are pleased that the BLM has issued a draft EIS and is moving to offer a lease.

The detailed comments of state agencies on the draft EIS are attached. As they state, the environmental impacts of multi-mineral development cannot be predicted with certainty because the techniques which will be used for mining, retorting, upgrading, and environmental control have not been tested extensively, especially on a commercial scale. Reasonable monitoring requirements and strict application of standards for environmental protection are necessary.

The State will make its recommendations about what should be offered for lease at the time of the Regional Oil Shale Team meeting, scheduled for December. At this point, we would like to point out three concerns with the proposed lease stipulations.

- The inclusion of a stipulation concerning socioeconomic impacts is most welcome. However, as drafted, the stipulation is inadequate. We recommend that at least the stipulation concerning socioeconomic impacts, transportation and applicability of local land use laws, included in recent coal leases in the Green River-Hams Fork region, should be included in future prototype oil shale leases. (77)
- In view of the significant impacts on wildlife, the BLM should consider including the Green River-Hams Fork wildlife stipulation on prototype oil shale leases. (185)

46

John Singlaub
September 16, 1982
Page two

o The firms which nominated the tracts have publicly expressed support for a stipulation requiring development of nahcolite and dawsonite as well as oil shale. Such a stipulation should be attached to the lease, since the purpose of this lease is to test multi-mineral technologies. (27)

We have additional concerns which relate to the minimum acceptable bid on the tract and to diligence requirements. The Department of the Interior should obtain a fair market value for the tract which includes the value of the nahcolite and the dawsonite as well as the oil shale. In calculating the minimum acceptable bid the Department should also give serious consideration, as a matter of businesslike management of a public resource, to the public costs that will be incurred by development of the resource. This would include the costs to the federal, state, and local governments of mitigating socio-economic impacts of development. As you know, the state's portion of the bonus payment and royalty from a lease are deposited in the Oil Shale Trust Fund, which is an important source for financing of public facilities needed to accomodate the development of oil shale properties. (186)

Setting the minimum acceptable bid for a multi-mineral lease will not be easy. We strongly suggest that the Department specify the criteria used in setting the minimum acceptable bid and that there be an opportunity for public review and comment before the lease sale.

Cordially,

Mont Pascoe

D. Monte Pascoe
Executive Director

DMP:ak
Attachments

46a

STATE OF COLORADO

COLORADO NATURAL AREAS PROGRAM
Department of Natural Resources
1313 Sherman Street, Room 718
Denver, Colorado 80203
Phone (303) ~~839~~ 866-3311

Richard D. Lamm
Governor

D. Monte Pascoe
Executive Director

Carol J. Pustmueller, Ph.D.
Program Director

September 20, 1982

Mr. John Singlaub
Oil Shale Leasing Project Manager
U. S. Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, Colorado 81644

Dear John:

We request your consideration of the following comments on the Prototpye Oil Shale Leasing Program DEIS submitted by the Colorado Natural Areas Program (CNAP), Colorado Department of Natural Resources.

The Colorado Department of Natural Resources and the Bureau of Land Management have a memorandum of understanding which describes a process for the identification and protection of those areas managed by BLM which qualify as state natural areas (e.g., possess unique natural characteristics of statewide or national significance). The Natural Heritage Inventory is managed by The Nature Conservancy for the CNAP. As you know, BLM contracted with The Nature Conservancy (TNC) to perform field surveys in 1982 in the Piceance Basin on the occurrences of rare, threatened, or endangered plants. The final report for this field work will be submitted by TNC to BLM on October 1, 1982.

The initial analysis of the data collected by TNC during the 1982 field season confirms three locations of *Astragalus lutosus* (dragon milkvetch), a Category 2 species (a sensitive species requiring additional data for consideration for federal listing by U. S. Fish and Wildlife Service) occurring on the proposed lease tracts C-11 and C-18. Preliminary indications from the data analysis are that no officially designated threatened or endangered plant species occur on the proposed lease tracts. We concur with statements made in the DEIS on Threatened and Endangered Plants (pages 77 and 145).

**46a**

Mr. John Singlaub
September 20, 1982

Page Two

Once the TNC report is submitted to BLM, and following an analysis of this report by CNAP, a further statement by CNAP will be submitted to BLM if it is determined that:

1. The status of Astragalus lutosus is such that BLM should implement protective measures on the three known populations on these tracts of this species prior to any surface disturbances on these tracts.

2. The data collected during summer of 1982 identify and support the need for protection of rare or quality native plant communities on either or both of these tracts.

Thank you for the opportunity to comment on this issue. If you need additional information, please contact me.

Sincerely,

Carse Pustmueller, Ph.D.
Director
Colorado Natural Areas Program

CP/ljc

**46b**

STATE OF COLORADO 1876

Richard D. Lamm
Governor

DEPARTMENT OF NATURAL RESOURCES
D. Monte Pascoe, Executive Director

**MINED LAND RECLAMATION DIVISION**
DAVID C. SHELTON Director

September 14, 1982

Oil Shale Project Team Leader
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, Colorado 81641

To Whom It May Concern:

The Colorado Mined Land Reclamation Division has reviewed the Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program. Below are comments regarding those areas with which the Division deals in our regulatory framework. The majority of the comments relate to pages 98-105 and 131-142.

It will be clear from our comments that we find some problems with the draft. However, we wish to emphasize our recognition that many of these problems stem not from the leasing program but from the experimental nature of the oil shale industry itself. Clearly, with proper monitoring and research we can all benefit appropriately from the knowledge gained -- and that is, in fact, your purpose in establishing the prototype program.

1. We are concerned with the light treatment given to the siting of spent shale disposal piles. The decision as to where the spent shale will be located is the most important decision. The location and configuration of the pile and its relationship to physical, chemical and biological environments will determine what designs and construction techniques are used and the eventual impact the spent shale will have on the environment. {111}

2. Throughout the document it is assumed that irrigation will take place. We are not sure that irrigation is advisable both from a revegetation point of view, or from a geotechnical and a geochemical point of view. {187}

3. On page 101 under the heading, "Spent Shale and the Shale Processing Waste Disposal", it is indicated that processing waste other than those that are considered to be hazardous under R.C.R.A. will be disposed of concurrently and in the same manner as retorted shale. This may or may not be possible or advisable depending on the characteristics of that waste and the effect those wastes would have on the retorted shale disposal pile. Under the same heading, it is stated that the factors affecting disposal practices of shale wastes involve expansion, compaction, cementation, permeability, seepage and leachates, and that these factors are directly related to the retorting process. Certainly this is true, but perhaps of more importance is the site where the disposal will occur. {111}

4. The discussion of compaction of spent shale on page 101 does not include the variables of siting and pile configuration. Whether or not compaction is necessary for slope stability will be dependent on the configuration of the pile. It should be noted that compaction in lower zones may not be necessary due to consolidation resulting from the overlying materials.

423 Centennial Building, 1313 Sherman Street Denver, Colorado 80203 Tel. (303) 866-3567

**46b**



5. Under the heading, "Permeability and Seepage In Spent Shale Disposal Piles" on page 102, it is stated that permeability of the disposal piles is directly related to the compactive effort the pile receives and the type of spent shale being compacted. This may be true for the upper zones in the pile, but in the lower zones, consolidation may be the ultimate variable which dictates permeability. Under the same heading on page 102, it is stated that seepage into spent shale disposal piles is directly related to permeability. In addition to the permeability, the rate of seepage or infiltration at the surface of the pile will be affected by evapotransportation. In fact, it may be possible to design a pile such that evapotranspiration would, on the average, equal infiltration, thus resulting in near-zero infiltration from the surface. (188)

6. On page 104 under the heading, "Above Ground Shale Disposal", it is stated that a capillary barrier would also be necessary to prevent upward migration of soluble salts if not leached below the root zone. It has not been proven that the capillary barrier would be effective in the long-term, nor has it been demonstrated that leaching of the salts to a zone below the root zone will be effective in the long-term. (189)

7. <u>Ground Water Quantity</u>

No Action Alternative (pg. 131)

Rio Blanco at lease tract C-b has used reinjection of water which was dewatered from the mine and also discharged this water to streams to augment water supplies. If such practices, or a combination of practices, were to be used during future mining at C-a and C-b, the alternative impact to the quantity of ground and surface waters may be considerably less than reported in this section. (190)

8. <u>Ground Water Quality</u>

No Action Alternative (pg. 133): Effects of Mine Dewatering (pg. 134)

These sections allude to the improvement of ground water quality of the lower aquifer (B-Groove) during the dewatering of this aquifer. This improvement will be the result of mixing of higher quality water from the upper aquifer (A-Groove). This scenario, however, does not take into account: 1) the degradation of A-Groove water through the leaching of soluble minerals within the Mahogony Zone and the Upper B-Groove; 2) the loss of higher quality water from the upper aquifer; 3) the economics of having to drill wells deeper to obtain ground water of lesser quality; and 4) the discharge or reinjection of water of poor quality during dewatering. The improvement of water quality in the lower aquifer, if it occurs at all, will be of little benefit to water users because of the depths to water. Therefore, this scenario appears to be of little significance as an environmental benefit of mine dewatering. (2)

In-situ retoring and backfilling of mine workings during mine dewatering may also accelerate the degradation of upper aquifer water, and also introduce soluble toxic organic and inorganic constituents not presently found in the lower aquifer. This water may require additional treatment before discharge.

9. <u>Surface Water Quantity</u>

Surface Water Modeling (Pg. 137)

The use of a surface water flow model to predict the effects of mining on the quantity of water at the confluence of the White and Green Rivers spreads the effects of mining too far from the area of the most significant impacts. Water in the White River and its tributaries within Colorado presently have been over-appropriated. Any impacts within the upper basin of the White River (153)

**46b**



should be given more emphasis, as these impacts will be magnified through the entire White River system downstream of mining.

10. <u>Surface Water Quality</u>

No Action Alternative (Pg. 140) and Mining (Pg. 140):

The analysis contained in the "No Action Alternative" and the analysis in the "Development Alternative - Mining" of impacts to surface water are not consistent. The "No Action Alternative" section alludes to an increase in dissolved solids due to dewatering at C-a and C-b, whereas the Mining section alludes to a decrease in salt loading due to dewatering. To be a valid comparison, the analyses in these two sections should be made consistent (e.g., either comparisons of dissolved solids or salt loads). (2)

11. Processing (Pg. 140)

Toxic heavy metals should also be discussed, because of their potential impact to the quality of ground and surface water.

12. Disposal of Spent and Raw Shale (Pg. 141)

Raw oil shale piles are not necessarily spoil piles and should not be grouped with retorted shale as a disposal problem because of the very different characteristics.

Other factors which should be considered in evaluating the quality of leachates and surface water from spent or raw shale piles are:

1. the thickness of cover placed over the reclaimed piles;
2. the use of liners under the piles;
3. the drainage system established around and over the piles;
4. sediment control systems located below the piles;
5. the engineering properties of the spent shale as related to slope stability and erodibility;
6. the engineering properties of the raw shale;
7. the geochemistry of the raw shale; and
8. the geochemistry of the spent shale. (113)

13. Leachates from Surface Disposal Piles (Pg. 141)

Due to the small particle size and high solubility of spent shale, leachates from spent oil shale piles will probably not have low concentrations of sodium, calcium, magnesium, and sulfate. The contribution of these elements to both surface and ground water systems may be significant. The presence of high amounts of alkali earth elements in marlstone and the temperatures produced during retorting will greatly alter the pH of the raw shale. Changes in pH may, in turn, mobilize toxic heavy metals at high pH. The mobilization of toxic heavy metals is a function of the retorting process employed, and the initial geochemistry of the raw oil shale. Stipulations requiring detailed geochemical analyses of the raw shale and the spent shale should be imposed on the leasee.

14. Runoff from Surface Disposal Piles (Pg. 141)

The quality and quantity of runoff is also a function of precipitation patterns. With about 50% of the precipitation occurring as snowfall, infiltration of melt waters into the piles is significant during snowmelt. Runoff is concentrated in periods of snowmelt and high energy thunderstorm events. The analysis, including high evaporation rates, is inappropriate since most percolation of water into raw shale piles and spent oil shale piles will occur during periods of low evaporation (e.g., snowmelt). Stipulations should be imposed on the lease to ensure adequate surface drainage over and around the piles, (2)

*adequate drainage of ground water from under the piles, and adequate controls to minimize infiltration.*

*15. Mitigation (Pg. 141)*

*The Division of Mined Land Reclamation has not favored the construction of diversion drains under or within spoil piles. Such drainage systems are subject to failure by corrosion, collapse, and clogging. Such systems would, thus, require long-term maintenance beyond the period of time the mine is in operation. The Division would prefer well engineered surface drainage systems around and across reclaimed and active piles. Well engineered underdrains are usually required to control ground water infiltration into the spoil piles.* (2)

*Another mitigative measure which should be considered is the covering of the spoil pile with an adequate mantle of non-toxic soil and rock material to ensure adequate revegetation and erosion control.*

*Heating of the kerogen-marlstone (oil shale) to over 800°C is unlikely to produce sufficient insoluble silicates, since Colorado oil shale is primarily a carbonate rock and has very little silica. Heating calcium and magnesium carbonates to these temperatures may produce highly alkaline calcium and magnesium oxides.* (2) (191)

*The incorporation of retort waste water and other processing waste waters into piles should be allowed only with a full understanding of the geochemical and hydrologic consequences of such disposal.*

*The last paragraph under "Mitigation", page 141, should be changed to read:*

> *If the above measures are incorporated, pollution of surface and ground water resources from leachates and contaminated waters may be minimized.*

*The following impacts of mining and oil shale processing were not considered in the analysis:*

1. *The cumulative impacts of mining oil shale and soluble sodium minerals on water quality, and*
2. *The effects of highly toxic catalyst wastes from retorting and upgrading facilities.* (2)

*Summary*

*The proposed leasing of tracts C-11 and C-18 as prototype projects should be handled as large experimental practices. The actual impacts of any development of oil shale in Colorado is purely speculative at this point in time. As the development of oil shale technology advances, there should be an equal advancement in environmental assessments and mitigative measures. To ensure that environment impacts of oil shale development are fully assessed, all facets of mining, dewatering, retorting, and disposal of wastes should be extensively analyzed and monitored during the development of the technology. It appears that the lease stipulations recognize the experimental nature of the oil shale industry and require the necessary monitoring.*

*Thank you for the opportunity to comment on the EIS.*

*Sincerely,*

*David C. Shelton*
*Director*

*DCS/mab*

---



STATE OF COLORADO
Richard D. Lamm, Governor
DEPARTMENT OF NATURAL RESOURCES
**DIVISION OF WILDLIFE**
Jack R. Grieb, Director
6060 Broadway
Denver, Colorado 80216 (825-1192)

COLORADO DIVISION OF WILDLIFE

## M E M O R A N D U M

TO: Steve Ellis
Colorado Clearinghouse

FROM: Al Whitaker AW
Wildlife Program Specialist

SUBJECT: Draft Supplemental EIS, Oil Shale Leasing Program, BLM

DATE: September 1, 1982

This agency has reviewed the above referenced document for content and accuracy. We offer the following comments.

1. The document gives a very accurate description of the existing wildlife environment and the impacts upon wildlife due to the proposed action. We emphasize that the document states that the impacts will be serious and long lasting.
2. We cannot see that a need for the proposed action has been proven. Indeed, nothing will happen on the proposed Federal leases that could not take place on existing private oil shale holdings.
3. The section on Uncommitted Mitigation on page 190 is well done and must be included as a stipulation of any future Federal oil shale lease, for at least partial protection of the State's wildlife resources. (192)
4. A viable alternative to No. 3 above would be inclusion of the wildlife stipulation contained in the Green River--Ham's Fork Coal leases. However, we prefer use of the uncommitted mitigation package as a lease stipulation. (185)
5. In the Uncommitted Mitigation section, busing of workers not only reduces highway mortality but also greatly reduces poaching.
6. If the proposed action is carried out, we prefer leasing of only Unit C-18 over C-11 or both.

ag

cc: Pete Barrows
Jim Morris

**46d**

# STATE OF COLORADO

DEPARTMENT OF AGRICULTURE
1525 Sherman Street
Denver, Colorado 80203
(303) 866-2811

Richard D. Lamm, Governor
J. Evan Goulding, Commissioner
Donald Svedman, Deputy Commissioner

Agricultural Commission
Naoma Benson, Sterling
Ben Eastman, Hotchkiss
John Malloy, Denver
Elton Miller, Fort Lupton
Don Moschetti, Center
William Stephens, Gypsum
William Webster, Greeley
Clede Widener, Granada
Kenneth Wilmore, Denver

MEMORANDUM
82-270

DATE: September 1, 1982

TO: Steve Ellis, Colorado Clearinghouse

FROM: Jim Rubingh, Colorado Department of Agriculture

SUBJECT: COMMENTS ON EIS FOR PROTOTYPE OIL SHALE LEASING PROGRAM

Colorado Department of Agriculture's comments are as follows.

1. Table IV-6 on page 126 is misleading. It states that there is significantly less conversion of cropland under Alternatives C-11, C-18, and the Combined Alternative than under the No Action case. Page 35, however, states that in addition to the land lost under the No Action alternative another 910 to 1,150 acres of agricultural land would be lost in the C-11 case. If Table IV-6 is meant to represent cropland losses in addition to the No Action alternative, it should indicate so in some manner.

2. The EIS should point out that much of the states orchard land is within Mesa County. Any projects which encourage additional urban development will threaten these unique farmlands. (The Soil Conservation Service considers orchard lands in Colorado to be unique if they are not classifed as prime. In Mesa County all orchard land has been classified as prime.)

   Orchard land in the state declined from some 15,000 acres in 1967 to 10,000 acres in 1979. Further losses of orchard acreage due to urban development could significantly harm the Colorado fruit industry.

(2)

RECEIVED 1982
DEPARTMENT OF NATURAL RESOURCES

RECEIVED SEP 1 1982
Division of Local Government

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**46e**

cde

COLORADO DEPARTMENT OF EDUCATION
State Office Building, 201 E. Colfax
Denver, Colorado 80203
Telephone (303) 839-2212
Calvin M. Frazier, *Commissioner*

DATE: Aug 30, 1982

SUBJECT: NON-STATE ASSISTANCE

REVIEW AND COMMENTS

TO: Bureau of Land Management

TO: ✓ (For Local Applicants)
Division of Planning
Department of Local Affairs

X (For State Applicants)
Non-State Funds Section
Office of State Planning and Budgeting

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AUG 31 1982
Division of Local Government

Project Title:

SAI Number:

Clearinghouse I.D.: 82-109

Comments Due By: Sept 1

Yes ✓ No ___ Is this project consistent with the goals and objectives of this agency?

Yes ___ No ✓ Is there evidence of overlapping or duplication with other agencies?

COMMENTS:

No additional comments.

Arvin C. Blome
Arvin C. Blome
Executive Assistant
Federal Relations 866 5344

SOC-3
4/81

46f

# COLORADO DEPARTMENT OF HEALTH

Richard D Lamm
Governor

Frank A Traylor, M D
Executive Director

MEMORANDUM

TO: Dewitt Joh, DNR

FROM: Paul Ferraro *Paul Ferraro*

DATE: September 15, 1982

SUBJECT: Review of "Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program"

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We have reviewed the Draft EIS, and we would like to discuss our comments in a meeting of representatives from BLM and the Department of Health.

As you know, the Department is going to issue soon its Draft Report, "Assessment of Cumulative Environmental Impacts of Energy Development in Northwestern Colorado". We feel a meeting would be of value in discussing the basic assumptions, methodologies, and results for both the Draft EIS and our report.

I will be contacting John Singlaub of BLM to set-up the meeting. I will let you know the time and place of the meeting.

PF:ts

4210 EAST 11TH AVENUE DENVER,COLORADO 80220 PHONE (303) 320-8333

46h

COLORADO HISTORICAL SOCIETY

The Colorado Heritage Center 1300 Broadway Denver, Colorado 80203

August 18, 1982

RECEIVED
AUG 19 1982
Division of Local Government

Mr. Stephen O. Ellis
Principal Planner
A-95 Clearinghouse
523 State Centennial Building
1313 Sherman Street
Denver, Colorado 80203

RE: Prototype Oil Shale Leasing Program, #82-109-Draft

Dear Mr. Ellis,

This office has reviewed the above environmental statement and has the following comments:

1. We request consultation with the Bureau of Land Management on the eligibility of the cultural resource sites located on Tracts C-11 and C-18. (193)
2. We request the opportunity to review the Gilbert/Commonwealth study currently being conducted on the Piceance Basin. We also request review of the results of the test for accuracy of the predictive model. This office is interested in how the BLM is going to put the predictive model into actual practice. (194)
3. Prior to completion of this study and the testing of its applicability to the Piceance Basin, any areas within the two tracts where ground disturbing activities are to take place should be surveyed for cultural resources if no survey has been completed for the area. (195)

If this office can be of further assistance, please contact the Compliance Division at 866-3392.

Sincerely,

*Arthur C. Townsend*

Arthur C. Townsend
State Historic Preservation Officer

ACT/WJG:ss

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AUG 2 1982
DEPARTMENT OF NATURAL RESOURCES

46i

STATE OF COLORADO

RICHARD D. LAMM
GOVERNOR

JOHN W. ROLD
DIRECTOR

COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
715 STATE CENTENNIAL BUILDING — 1313 SHERMAN STREET
DENVER, COLORADO 80203 PHONE (303) 866-2611

August 12, 1982

RECEIVED
AUG 16 1982
Division of Local Government

Mr. Stephen O. Ellis
State Clearinghouse
1313 Sherman St., Rm. 523
Denver, CO 80203

Dear Stephen:

RE: EIS #82-109 DRAFT,
OIL SHALE LEASE TRACTS C-11, C-18

We have reviewed the supplemental EIS for additional prototype oil shale leases in Rio Blanco County. The document adequately outlines the impacts to water, mineral and other natural resources which can be expected to occur if one or both tracts are developed. Impact to local surface and groundwater quantity and quality appears to be a significant problem in the proposed lease area. We concur with the recommendation that zero discharge programs for leachates and retort waters be adopted for these tracts.

We would also like to emphasize the impact on mineral resources should these tracts be developed. As stated in Chapter IV, the lease tracts contain the thickest sequences of nahcolite/dawsonite bearing oil shales in the Basin. Current estimates are that 70% to 80% of the resource in the lease area would be lost using present mining technology.

All long-term impacts to natural resources should be carefully weighed during the decision making process.

Sincerely,

Bruce K. Stover

Bruce K. Stover
Engineering Geologist

vt

GEOLOGY
STORY OF THE PAST . . . KEY TO THE FUTURE

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A-95 Review No. 692

46j

STATE OF COLORADO

DEPARTMENT OF HIGHWAYS
Grand Junction, Colorado 81502
(303) 242-2862

August 13, 1982

RECEIVED
AUG 17 1982
Division of Local Government

Mr. Stephen O. Ellis
State Clearinghouse
520 State Centennial Building
1313 Sherman
Denver, CO 80203

Dear Stephen:

District III of the Colorado Division of Highways has reviewed the Draft Supplemental EIS (DSEIS) for the Prototype Oil Shale Leasing Program and has the following general comments.

As our interest is primarily in transportation-related impacts to the State Highway System, we would request that leasing/mining alternates be developed which result in the least damage and congestion on the State highways serving the oil shale region.

If oil shale lessees elect to haul products/equipment, etc. on the State Highway System, we will be requesting specific improvements and financial assistance in the repair and/or maintenance of State highways resulting from oil shale leasing companies hauling activities. (77)

As noted in the DSEIS, major improvements to the State Highway System would be very expensive to implement while very necessary in many areas (SH 13 north of Rifle, SH 64 west of Rangely); therefore, we recommend alternative transportation modes for product movement be developed and worked into early plans for the oil shale leasing program.

In addition, any new access points onto the State Highway System resulting from this program will require that an Access Permit Application be filed with this District and that necessary improvements stipulated in the access permit be designed and constructed in

46j

Mr. Stephen O. Ellis
August 13, 1982
Page 2

accordance with the requirements included in the State Access Code (copy attached).

We appreciate the opportunity to review this document at this time.

Very truly yours,

R. P. MOSTON
DISTRICT ENGINEER

Laurence R. Abbott
By LAURENCE R. ABBOTT
DISTRICT ENVIRONMENTAL MANAGER

LRA/jme

Enclosure

cc: Clevenger
Atchison
Moston/Sturm
Bradbury
Kier
Spanicek
Campbell
File

46k

RICHARD D. LAMM
Governor

JERIS A. DANIELSON
State Engineer

STATE OF COLORADO 1876

**OFFICE OF THE STATE ENGINEER**
DIVISION OF WATER RESOURCES

1313 Sherman Street-Room 818
Denver, Colorado 80203
(303) 866-3581

September 1, 1982

TO: Stephen O. Ellis, State Clearinghouse

FROM: Hal D. Simpson, P.E., Assistant State Engineer Hal D. Simpson

SUBJECT: Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program.

As requested, our office has reviewed the EIS for the leasing of one or two additional prototype oil shale leases in the Piceance Basin. In general, we believe the EIS is well presented and adequately addresses the issues that concern our office at this stage of planning. We will review any specific water right or augmentation plan application when it is filed in Water Court.

We do suggest the following revision to the EIS. Paragraph 2 of page 36 states a water augmentation plan will be required under state water law to replace lost sources of water due to mine dewatering. Though in effect this statement is probably correct, it would be more accurate to state that any losses of water which would result in injury to senior appropriators must be replaced. Also, as stated later in the EIS, all augmentation plans that would involve the Piceance Basin must be approved in Division 5 Water Court. (2)

HDS/JRH:pkr

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SEP 3 1982
Division of Local Government

47

SOHIO

September 20, 1982

Mr. John Singlaub
Prototype Leasing EIS Team Leader
Bureau of Land Management
White River Resource Area
P. O. Box 928
Mecher, CO 81641

Dear Mr. Singlaub:

Sohio Shale Oil Company appreciates the opportunity to express our comments on the Draft Supplemental Environmental Impact Statement (DEIS) for the Prototype Oil Shale Leasing Program.

Detailed comments on the air quality, socio-economics and hydrology segments of the DEIS are attached. These comments identify significant inadequacies in the data and evaluations presented in the DEIS. Such inadequacies should be addressed and corrected, particularly if BLM expects to use the same baseline information, assumptions and evaluations in the permanent leasing program EIS.

Again Sohio Shale Oil Company appreciates the opportunity to comment. If you have any questions concerning our comments please do not hesitate to call me.

Sincerely,

Terry F. LaMore

Terry F. LaMore

TFL/ks

47

Supplemental DEIS - Prototype Oil Shale Leasing Program

Air Quality

(196)

1. Would the USEPA or the State accept the use of the TAPAS model?

2. Did BLM consult EPA of the State regarding the selection of models?

3. How does TAPAS compare to EPA models and to other sophisticated complex terrain models?

4. In the air quality impacts section. BLM briefly discusses the modeling approach and its shortcomings much as conservatism and adsolute-worst case. This should appear at the beginning and be more thoroughly discussed, since the assumptions made in the modeling are most likely the cause of the large impacts predicted. It is important to note that in the Air Quality Technical Report (Dietrich, et. al.), the authors readily identify the shortcomings and also say that detailed analysis may yield different results. Also, the conclusions of the technical report are that maximum development may approach or exceed national ambient air quality standards. This conclusion seems to be lost in the BLM document, as they say that the no-action alternative results in standard and increment violations. (32)

5. In comparing this DEIS to the Uintah Basin EIS, I have found discrepancies in source data. Emission rates for projects are not the same. Also, the number of projects included in each report is significantly different. (14)

6. In the prototype DEIS, selected meteorological conditions were used and meteorological data from the area were input into a wind model. Basically, they selected a set of conditions (4 m/sec, West, and E stability) and the wind model gave flows for terrain effects. In the UBDEIS, actual meteorological data were used as well as a complex terrain wind model to give simulated meteorological conditions for a full year. The UBDEIS approach is much more sophisticated and preferred. (144)

7. In the prototype DEIS, the contractor did everything possible to predict maximum impacts. In their modeling, they assumed that the input meteorological conditions persisted for 24 hours. This was due to insure maximum impacts in wilderness areas. This approach is extremely conservative. For example, the EPA Valley model is considered overly conservative and should be used only for screening. In the short-term Valley model, the meteorological conditions for worst case, although input as lasting 24 hours, are actually calculated as occurring six hours. (81)

-2-

8. The TAPAS model used is a Gaussian Puff Model (GPM) which, according to some contractors, overpredicts short-term (24-hour) impacts by a factor of 5. This overprediction by the GPM is referred to in the technical report. As an example, I have compared predictions from the two documents. In the prototype EIS, the 24-hour $SO_2$ impact at Rifle is $865/g/m^3$ while the Uintah Basin report predicts a range of $1\text{-}11/g/m^3$. There are a number of factors that could result in this difference and include emission rates, sources, meteorological data, and modeling techniques. (34)

9. The prototype DEIS predicts some rather high $NO_x$ impacts on a 24-hour basis. However, there is no 24-hour standard for $NO_x$. Thus, it is completely out of line, in my opinion, to compare these results to the annual standard. In the Uintah Basin DEIS and support document, it says that $NO_x$ was evaluated and found to be insignificant. Why is there such a large difference between the two documents? (83)

10. In the prototype DEIS, the contractor used the GPM for all receptor locations. Others have reported that GPMs overpredict near point sources ( 5 km). In the Uintah Basin report, Complex I was used for near source impacts.

11. For the Uintah Basin DEIS, the contractor, SAI, says that, if all Utah and Colorado projects proceeded at the high level, there is a small but nonzero probability that Class I increments in Flat Tops and Mr. Zickel would be exceeded. This is a substantially different view from the one gotten after reading the Prototype Draft EIS. (247)

Socio-economic

1. Analytical tools commonly utilized for such analysis have not been employed. This leads to an unsubstantiated evaluation.

2. Implications and possibilities of negative impacts are discussed without the employment of empirical data and defensible methodology. (36) (130)

3. Positive benefits such as increased tax base, jobs, etc. are incompletely addressed in the DEIS. (124)

Hydrology

1. The uncertainties in modeling the hydrologic systems in the Piceanse Basin need to be addressed in more detail in the DEIS. The models employed are largely unvalidated.

2. Extensive data bases, which already exist, should be used in the projections. A realistic perspective is needed in dealing with the modeling uncertainties. (135)



**Mobil Mining & Coal Division**

P.O. BOX 17772
DENVER, COLORADO 80217
A DIVISION OF
MOBIL OIL CORPORATION
PALMER C. FUSELIER
GENERAL MANAGER U.S.
TELEPHONE (303) 620 6380

September 21, 1982

EIS Team Leader
White River Resource Area
U.S. Bureau of Land Management
P.O. Box 928
Meeker, Colorado 81641

Draft Supplemental Environmental Impact Statement For The Prototype Oil Shale Leasing Program

Dear Sir,

This letter is in response to the request by the Bureau of Land Management (BLM) for public comments on its Draft Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program (DEIS) (47 FR 31080, July 16, 1982). Mobil Oil Corporation (Mobil) appreciates the opportunity to respond to BLM's above-referenced DEIS.

The DEIS reflects the Prototype leasing program's focus on demonstrating specific, "untried" technologies. This stems from the apparent conception that other technology alternatives, including direct mining and surface retorting of the oil shale, have already been adequately demonstrated under the Prototype Program, and therefore, are excluded from consideration. In reality, no retort technology has yet been commercially proven and developed.

We recognize the difficulties faced by BLM in dealing with the complexities inherent in the development of the DEIS with the limited time and manpower available. However, we are concerned that the analysis presented in the DEIS appears to contain numerous inaccuracies, which undermine the validity of the DEIS. As it stands, the DEIS is likely to impose unwarranted long-term environmental limitations on future shale development in the Piceance Basin.

We feel the DEIS presents an unrealistic worst case environmental scenario based on overly pessimistic assumptions and an unrepresentative air dispersion model. Furthermore, the analysis does not include alternative scenarios with a range of potential impacts or measures to reduce, mitigate or prevent adverse impacts, as required by NEPA process.

**Mobil**

EIS Team Leader
September 21, 1982
Page 2

The following briefly highlights our most serious specific concerns.

Air Quality

The DEIS overstates the air quality impacts, particularly with reference to the town of Rifle, Colorado. In general, high pollutant concentrations identified in the DEIS are primarily a function of overly pessimistic input assumptions and the application of a dispersion model that is inappropriately applied to the given topography. Furthermore, most of the impact analysis is based on an unrealistic worst case model and fails to adequately consider the caveats listed in the Technical Report accompanying the DEIS. (32) (33) (34) (81)

Hydrology

The hydrology sections of the DEIS oversimplify the complex Piceance Basin hydrologic system and project substantial impacts on local surface and ground water based on regional modeling. Application of results of regional modeling to specific sites raises questions regarding the validity of conclusions. This problem is most apparent with regard to Mahogany Zone leakage and interaquifer exchange in the vicinity of Tracts C-11 and C-18, where data is insufficient to establish the results indicated. (135)

Socioeconomics

The socioeconomic analysis is based solely on population growth and does not address all the factors which will affect the local communities. The economic characteristics of the area are more complicated and a comprehensive socioeconomic analyses should consider the whole range of human and community characteristics and needs. (118) (130) Furthermore, the methodology assumptions used to predict project development, labor requirements, growth rates, and social and economic impacts are unclear. (130)

Additional comments on these and other sections of the DEIS are contained in the accompanying Attachment.

We feel that the DEIS greatly exaggerates the potential impacts of the No Action Alternative. Thus, the projected results of the proposed lease sales alternative are also distorted. We request that BLM reflect the comments contained in this letter and accompanying Attachment in the Final Environmental Impact Statement.

If you have any questions, please contact Grove L. Higgins, Jr. at 303-628-6171.

Very truly yours,

Palmer C. Fuselier

GLHiggins/LJTimlin/ss
Attachment

cc: W. H. Marshall - MOC - New York



ATTACHMENT TO MOBIL'S COMMENTS ON BLM'S
DEIS FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM

## AIR QUALITY

In general, the impact analysis overstates the potential air quality problems that could arise. Exceedances can be attributed to the overly conservative and unrealistic assumptions used in the modeling. (81) Many of the statements in the DEIS, based on the results of the worst case analysis, fail to include the qualifications listed in the accompanying Technical Report on Air Quality (David L. Dietrich, "Air Quality Impact Assessment for the Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program", July, 1982). (32) More importantly, we believe that the modeling needs to be performed with more realistic technical assumptions. (81) We also question the suitability of the TAPAS model for the terrain encountered in the Piceance Basin. If remodeling is not possible, we believe the DEIS discussion should, at a minimum, include the qualifications presented in the Technical Report. (33)

### Technical Assumptions

We urge that the following technical assumptions be reexamined more thoroughly: (79) (144)

1. The meteorological events leading to these worst case predictions were hypothesized. There is no evidence that such combinations of events occur or have previously occurred in the region.

   - It was assumed that winds blew from one direction for 24 hours with no alteration of direction. This meteorological phenomenon does not occur in nature.

   - Winds were assumed to blow at a steady 4 meters per second for 24 hours. This meteorological phenomenon does not occur.

   - The atmospheric turbulence condition was assumed to be a constant E stability category for the entire 24 hours. This stability category is normally observed under nighttime conditions only and rarely occurs during daytime hours. As a result of using E stability, plume spread is greatly reduced, leading to high predicted concentrations at ground level.

   - The mixing height or inversion level was assumed to remain constant for 24 hours at 800 meters. Observed levels vary from 200 meters at night to 2,000 meters during the day. Plumes from tall stacks (e.g., power plants) can rise above the assumed mixing height during the night and thus have very little ground level impact.

### Air Quality Modeling

The BLM model is inappropriate for the terrain encountered in the Piceance Basin. (33) (59) The dispersion model (Topographic Air Pollution Analysis System, TAPAS) used in this BLM study is more complicated than the EPA Gaussian dispersion models usually used for worst case impact studies (e.g., VALLEY). This TAPAS model first generates a gridded wind field. That is, the region is divided into 2.8 x 3.5 km grid squares. Winds enter the grid from the speed direction at the initial speed of 4 meters per second. They blow through the grid, changing direction and speed, as they encounter terrain shapes. The

grid has a lid imposed on it, the 800 meter mixing height, preventing vertical movement of pollutant higher than 800 meters from the terrain. However, the lid follows the terrain forcing pollutants released from a stack at the 8,000 foot elevation, for example, to behave as though it had been released from the same stack at 6,000 feet if the terrain drops to 6,000 feet downwind. Once the wind direction and speed of each grid is established, the model holds them constant for 24 hours. Puffs of emissions are tracked from each source at 10 minute intervals as they move through the grid. The puffs grow in size and diminish in concentration at a rate determined by the specified turbulence conditions, a constant E stability category for this study. For every puff entering a grid, an equal mass must leave the grid in order for conservation of mass to be maintained without increasing the grid pressure over that of its neighbors. We believe that if the wind encountered certain combinations of terrain, the model establishes a circular pattern, causing the same puff to cross a grid point many times and thus be counted in the 24 hour concentrations many times. This condition would seem to violate the conservation of mass requirement. The abnormally high concentrations predicted for Rifle appear to be the result of such modeling artifacts. Models which allow movement in the vertical as well as horizontal directions are less likely to encounter this problem. (34) (61)

In the BLM model used in the DEIS, reducing the dimensions of the grid, which should permit more precise estimates, reduces pollutant concentrations in critical areas (phone SSWise/DGFox, USDA Forest Service, 8/23/82).

The BLM model has been tested only in areas in California where similar terrain conditions do not exist. Uncertainties such as these should be stated before such definitive statements are made in the DEIS. (33)

Additional Comments

The projected Class I PSD increment exceedances for Mt. Zirkel and Flat Tops in the baseline case are related to very conservative and unrealistic assumptions used in the modeling. (81)

Table 1-3, page 20, of the Technical Report lists the coordinates of the sources considered. In addition, these locations are plotted in Figure 1-2 on page 6. The location of the Superior Project should be approximately x/y coordinates 9/22 rather than the indicated 30.5/32.0. Also, the y-coordinate for Rio Blanco should probably be 28.5 instead of the value 18.5 listed in Table 2-3. Rio Blanco, however, seems to be located correctly in Figure 1-2. (14)

## HYDROLOGY

The Hydrology sections oversimplify a very complex hydrologic system. The complexities of the regional hydrology of the Piceance Basin are exemplified (88) by the current studies being conducted by the USGS (Taylor, et. al) to further define, quantify, and modify the work of Weeks and others. The discussion of ground-water hydrology appears to be particularly in need of clarification (2) and/or substantiation. A general lack of data in the text tends to detract from the credibility of the DEIS. The DEIS appears to rely heavily on regional studies rather than site specific data to support assumptions and conclusions. (135)





The DEIS has projected substantial impacts to both surface and ground-water resources based largely on modeling results by the USGS (Weeks, Taylor, etc.). Application of results of such regional modeling to site specific areas such as Tracts C-11 and C-18 raises significant questions regarding the validity of conclusions. This situation is most apparent with regard to the question of Mahogany Zone leakage and interaquifer exchange in the vicinity of Tracts C-11 and C-18. There is insufficient data to establish site specific leakage of Tracts C-11 and C-18. The issue of leachate transport and migration has also been treated superficially. This attempt to simplify or abbreviate complex issues has resulted in contradictory or confusing discussions. (2)

Specific comments on the Hydrology sections of the DEIS, discussed by subject area and chapter, are as follows:

Ground Water Quantity - Chapter III, Page 72

1. The DEIS states that the estimates of ground water in storage may "range up to 25 million acre feet." This represents an upper limit. There is no discussion of possible lower limits. There is a wide range of values attributed to this resource by several state and federal agencies which should be addressed. (167)

2. Aquifer properties and associated values are discussed in a rudimentary format. An average value is given for transmissivity (t) of the upper aquifer but no range of data is given. Since the text itself states this is an area of fracture permeability, a wide range of values would be expected and this information is pertinent to the discussion. No source of data or location of testing which produced this data is given. The reference cited (Fox, 1980) does not appear in the Bibliography. (2)

3. The discussion of the hydrologic role of the Mahogany Zone with respect to the upper and lower aquifers is ambiguous. This zone is described as relatively impermeable, then later described as permitting "some degree of vertical exchange of water between aquifers" due to fractures. An estimate of the upper limit of the vertical hydraulic conductivity is presented but no lower limit or range is given. It should be noted that some tests conducted on the Mahogany Zone have found no vertical hydraulic conductivity (Knutson, et.al., 1973, Hydrology of Rio Blanco Site [abs.]: American Nuclear Society, Trans., V. 17, pages 19-20) and no horizontal conductivity (Weeks and Welder, 1974). No discussion is presented as to the site specific hydraulic characteristics of the Mahogany Zone on Tracts C-11 and C-18. (88) (91) (160)

4. No values are given for aquifer characteristics in the lower aquifer. Some data is apparently available but not presented. Transmissivities within the leached zone (lower aquifer) are generally higher than in the upper aquifer as stated in the text. However, limited testing of the lower aquifer within the lease tracts indicate that this is not the case. No explanation or discussion is presented regarding this anomaly. (2)

5. The regional hydrologic flow regimes are described in a rudimentary fashion. Potentiometric head maps would be beneficial to an understanding of the hydrologic regime and relationship of discharge (167)

and recharge areas to Tracts C-11 and C-18. The statement that the lease tracts are within a discharge area (paragraph 6) conflicts with earlier statements in the text (paragraph 3). (2)

6. The statement that "current use of ground water within the basin is minimal" does not adequately address this consideration. There are numerous adjudicated conditional water rights for ground water withdrawals within this area which have been ignored in the DEIS. It is important to address these rights because it is a very relevant consideration with respect to impacts under Chapter IV. These rights are available from listings in the Colorado State Engineer's Office. (197)

Ground Water Quality - Chapter III, Page 72

1. Water quality is discussed based on samples withdrawn in the vicinity of lease Tracts C-11 and C-18. However, no sample locations are identified. This could be addressed either in the text or through utilization of a map. Since there is a wide variability of water quality within the basin, both vertically within aquifers and spatially across the basin, this information would be of considerable value. Much of this information is available from public records through state or federal agencies. (2)

2. The discussion of fluorides presents an average concentration of 28 mg/l in the lower aquifer. No range of values is given for the 27 wells sampled. The value presented appears very high and, therefore, warrants some indication of ranges of values and locations of wells sampled within the basin. Other data available indicates this average value may be anomalously high ("Ground Water Monitoring Review," V. 2, No. 3, 1982, pages 27-32).

3. The discussion of water quality states that concentrations of barium exceed drinking water standards in 7 out of 11 wells sampled. No data is given to support this or indicate concentrations (or range of concentrations) found. The discussion indicates levels of boron and lithium are high enough to be toxic to plant life; however, no indication is given as to site specific data for these parameters on Tracts C-11 and C-18. Recent data ("Ground Water Monitoring Review," V. 2, No. 3, 1982, pages 27-32) indicates a large variability in boron levels across the basin. No data is provided to substantiate this statement. (254)

Surface Water Quantity - Chapter III, Page 75

1. Surface water flow data is cited in numerous places in the text but no source is identified. It is assumed that this is USGS gaging data and should be indicated as such.

2. Table III-9 appears in the text in numerous places and is cited throughout the surface water discussion. There are several discrepancies in this table. No source of data presented in Table III-9 is provided. Average annual discharge is given in cubic feet per second (CFS) in the table. While this is an acceptable unit of measurement, it would be more consistent with the text to use acre-feet. The average annual discharge given in Table III-9 for Piceance Creek is 10,518 CFS which converts to approximately 20,857 acre-feet per year (AF/yr). This value is inconsistent with the (2)





18,330 AF/yr value presented in the text on page 75. No average values are presented for sediment discharge or TDS values, only maximums and minimums.

3. Table III-9 and page 75 of the text indicate a peak instantaneous discharge for Yellow Creek of 6,800 CFS. The text indicates that this is a flood peak and it can be assumed that this represents an unusual storm event of extreme severity. However, the maximum peak discharge of Piceance Creek with three times the drainage area is only 628 CFS. An explanation of this anomalously high value of Yellow Creek should be provided. (2)

Surface Water Quality - Chapter III, Page 76

1. No reference or source of data is cited in the text for the water quality data given in this section.

2. The text indicates a maximum daily sediment yield of 90,000 tons per day for Yellow Creek as opposed to 2,900 tons per day for Piceance Creek. It appears that the peak sediment load corresponds with flood events on each watershed.

General - Chapter IV

1. The statement that "Impacts for lesser development are described as a percentage of the worst case analysis" is based on the unsupported assumption that a direct linear relationship exists between production rates and ground water impacts.

2. The statement is made that modeling results indicate there could be impacts to "springs, wells and public water reserves." There is no description of the referenced public water reserves and they are not discussed or identified elsewhere in the text. (198)

Ground Water Quantity - Chapter IV, Page 131

1. Under the No Action Alternative the statement is made that "Springs deriving their water supply from the lower aquifer would be affected as a result of large drawdowns." (emphasis added). This appears to conflict with the basic assumption that the lower and upper aquifers are in hydrologic connection via Mahogany Zone leakage discussed elsewhere in the text. If this is the case, all springs as well as surface water supplies could potentially be affected and the effects on any one aquifer would be lessened.

2. The ground water model description needs elaboration. No discussion of methodology utilized is provided so that the reader will have a full understanding of its application. No discussion is provided regarding parameter inputs, assumptions, or boundary conditions used in the modeling process. No discussion is provided as to how fracture permeability was considered and leakage factors were incorporated. If conditions/inputs/assumptions used were the same as the 1974 study (Weeks, et.al., 1974), a statement to this effect should be included. (2)

3. The discussion of mine dewatering and impacts requires extensive clarification and correction of errors. This section would greatly benefit from the inclusion of appropriate diagrams, tables, and maps

to support the discussion. Among the items which should be included are: location map of simulated wells, table of pumping rates vs. time, hypothetical well diagram, and table of model assumptions and parameters.

4. The mine dewatering discussion indicates that complete hydrologic connection is assumed between both aquifers and surface water flows in the basin. While it can be assumed that some leakage occurs between the upper and lower aquifers, the term "complete" may be misleading to the reader.

5. The mine dewatering scenario used in the model indicates 15 wells pumping at 2.5 CFS and 3.5 CFS for periods 1 and 2, respectively. These rates correspond to 1,122 and 1,571 GPM, respectively, which conflicts with the text on page 72. The text indicates that a maximum yield of only 1,000 GPM can be expected from wells in the lower aquifer. The discussion on page 72 and the modeling described on page 132 appear to conflict.

6. The first sentence of the sixth paragraph is ambiguous and should be rewritten for clarity. It is unclear whether the "larger pumping rates" described in the sixth paragraph are greater than the 3.5 CFS of period two or whether the author is referring to the increased pumping during period two.

7. Figure IV-8, page 130, should be relabled for clarity. Original static water levels should be indicated on the figure. The third period (recovery) should be labeled and model inputs such as T, S, P', and Q should be indicated.

8. The value given in the last (seventh) paragraph, first column of page 132 is erroneous. The value should be 37.5 CFS.

9. The discussion of mine dewatering with reinjection wells is ambiguous. It is suggested that the first and second sentences be exchanged for additional clarity.

10. It is unclear which two streams the text is referring to under "Surface Discharging of Excess Mine Water." The discussion of "bank full conditions" is unclear and requires additional discussion. In view of the normal low flow or no flow conditions experienced on these streams, the probability of excess mine water creating bank full conditions would appear very slight. (2)

11. The use of the term "groundwater" in the first sentence of the text on "Impacts to Existing Sources" should be deleted and "potentiometric surface" or "potentiometric head" inserted in its place. It is unclear whether the 10-foot decline discussed in the text is referring to the upper, lower, or both aquifers. No discussion is presented regarding impacts to undeveloped future rights held in this area in addition to existing sources.

12. The text of discussion under "Mine Development Alternative" refers to the assumption that impacts from 25,000 barrels per day (BPD)





production could be assumed to be one quarter of that of 100,000 BPD. We question the basis for this assumption.

Ground Water Quality - Chapter IV, Page 133

1. The decreases in TDS projected under the No Action Alternative appear to be a temporary phenomena during the mining period. No discussion is presented on temporal conditions or temporal variability of ground-water geochemistry. (249)

2. The broad, generalized statement that "Significant impacts could occur . . . as a result of any production rate." should be expanded in the discussion. (167)

3. We question why "mixing of aquifers" is indicated as critical under "Aquifer Mixing Through Mine Development." The text should specify that the discussion herein refers to upward flow from the lower aquifer to the upper aquifer. According to the text on page 72, this upward flow occurs naturally in discharge areas of the basin. We question how and why this situation is different.

4. The discussion under "Leaching of Subsurface Retort Chambers" addresses the types of contaminates generated and time estimates for leachate transport to Piceance and Yellow Creeks. No discussion is presented as to what effect attenuation and dilution would have on leachate migration over the potential 100 to 200 year period indicated. (2)

5. The discussion under "Effects of Mine Dewatering" addresses the potential for changing ground-water flow direction in the aquifers. It appears that this reversal (change) of flow direction would be a localized phenomena and not basin wide. No discussion is presented on the spatial extent of this phenomena.

6. The discussion of "Ground-Water Use" does not address potential future users in addition to existing users. What impairment could arise to other water right holders presently not utilizing this resource? (197)

Surface Water Quantity - Chapter IV, Page 137

1. The Table cited in the text under "No Action Alternative" should be IV-8 rather than III-10 as given. Table IV-8 is vague regarding what assumptions were used. Footnote 1 does not specify what scenario for development was utilized in Table IV-8. Footnote 2 does not specify what population increases were projected in Table IV-8. (2)

2. The modeling runs conducted by the Bureau of Reclamation for surface water quantity cite a data base of the 1951 period. If this date is correct there is no explanation why only one year of flow data was utilized. (199)

3. We question why ground water utilization was not considered under the modeling effort for "Impacts to the White River." (2)

4. An explanation and discussion is warranted regarding the statement ". . . the assumption of perfect long-term connection between surface and ground water systems." under "Impacts to Piceance and Yellow Creeks" (emphasis added). In addition, an explanation is warranted as to how the model continued to deplete surface water after historical flows were gone.

5. We question whether the 450 CFS shown under the No Action/Net Flow category on Table IV-9 represents the historical average flow available. This should be clarified. Also, it is unclear what baseline flow data was used to simulate future flows derived in Table IV-9.

Surface Water Quality - Chapter IV, Page 140

1. Discussion under the No Action Alternative indicates that mine dewatering at Tracts C-a and C-b will increase total dissolved solids (TDS) in Yellow and Piceance Creek, respectively, as a result of decreased ground water contribution. The discussion in the DEIS immediately preceeding "Surface Water Mitigation" suggests the possibility of utilizing ground water as a mitigation measure to supplement decreased surface water flows. These two ideas appear contradictory and mutually exclusive without some degree of explanation. In addition, if the assumptions stated on page 137 that a perfect long-term connection between surface and ground water systems exists, utilization of ground water to mitigate depletion of surface water would appear to be fruitless unless the source area is spatially and hydrologically removed from the depleted streams. (2)

2. Decreased surface water flows resulting from mining are projected in the DEIS to reduce salinity concentrations in the Colorado River. No data or discussion is presented regarding ranges or projections for this decrease. This information would be helpful to assess the degree of positive impacts resulting from the lease action. The discussion presented also projects total salt load reduction in the White River due to reduced flows from depletions in Yellow and Piceance Creeks. No data or source of data is presented to indicate how the values were derived.

3. The depletion listed for the White River due to reduced flows from Yellow and Piceance Creeks is 4,350 AF/yr. Table IV-9 lists a depletion of the White River at the confluence of the Green River of 8,000 and 16,000 AF/yr for 50,000 and 100,000 BPD production, respectively. While the location of depletions shown in Table IV-9 is further downstream, the two values appear to conflict. No explanation is given.

4. The discussion under "Leachates from Surface Disposal Piles" indicates high concentrations of Ca, Na, Mg, and $SO_4$ may result from leaching. No quantitative estimate of anticipated concentrations is provided.





SOCIOECONOMICS

The socioeconomic concerns expressed in the DEIS are identified as major, yet the impacts and future revenues are based solely on population growth. Neither human nor community characteristics or needs are identified. The economic characteristics of the area are more complicated than the DEIS analysis indicates. Comprehensive socioeconomic analyses should consider the whole range of human and community characteristics as well as the interrelationships among these characteristics. Furthermore, the methodology and assumptions used to predict project development, labor requirements, growth rates, and social and economic impacts are unclear. (118) (130)

Overall, without a clear statement of assumptions and a discussion of methodology, the conclusions presented in the DEIS are subject to multiple interpretations and can easily result in misunderstandings. It is important to specify the criteria used in determining impact rankings. Otherwise, those impacts can become subjective and may be misconstrued. Moreover, inconsistency in the application of the data appears throughout the DEIS and results in a lack of focus and confusion on interpretation.

Assumptions and Methodology

It is not clear what assumptions are used for coal, oil, and gas development; that is, are specific projects included or is a growth rate assumed? Moreover, the methodology and assumptions used to define the study area for social and economic impacts are unclear.

Assumptions on settlement patterns, work force schedules and the number of workers for both construction and operating periods are not discussed for all of the projects assumed in the DEIS base case. Project schedules, work force schedules and levels of construction and operation, and assumptions on settlement patterns are not provided for the DEIS alternatives. It is unclear whether indirect employment and population are included in the projections throughout the DEIS and, if so, what assumptions and methodology (multipliers, settlement patterns, demographic characteristics) were used to determine indirect employment and population. (36) (130)

The assumptions used to establish the percentage of local and non-local construction and operations workers, family size, and percentage of single and married construction and operations work force are not identified in the DEIS. Moreover, we question whether it is reasonable to assume that secondary population growth will occur in Glenwood Springs and Carbondale, and not in Silt or Parachute.

Inconsistencies

We note that project data, including schedules, work force levels and settlement patterns, are not provided consistently for each project.

The definition of the study area appears to be inconsistent in several sections of the DEIS. For example, on page 4 Rifle and Meeker appear to be included, and on page 33 Rifle, Meeker, and Rangely appear to be included. However, on page 36 Rifle, Meeker, Rangely, Glenwood Springs, Carbondale, Silt, Parachute, and Grand Junction are included.

In addition, the DEIS states that seven towns will be affected (Glenwood Springs, Rifle, Silt, Parachute, Grand Junction, Rangely, and Meeker). Of these, the DEIS indicates that Parachute and Grand Junction would not be "significantly affected." However, Table IV-20 indicates that under certain alternatives Silt, New Castle, Glenwood Springs, and Carbondale would also be affected "insignificantly." If no secondary population was allocated to Silt or Parachute, we question why Silt is identified as being more significantly affected than Parachute. (200)

Analytical Criteria

In general, we note the absence of identification of the criteria used to establish the social and economic study area. It is unclear whether the criteria developed for ranking social impacts were used for economic impacts, or whether other criteria were utilized as a basis for the statements on the level of economic impacts.

Social and economic community impacts appear to be ranked from "insignificant" to "very severe" throughout the document. These impact criteria are established in Chapter IV, page 165 and were apparently developed for determining social impacts. We question how social impacts can be determined solely on the basis of population growth with no analysis of the existing infrastructure capabilities of the communities. Furthermore, we question how economic impacts can be assessed solely on the basis of population growth with no assessment of the total financial capabilities (revenues and expenditures) of the community and county governments. (130) (200)

Finally, quality of life is an economic as well as a social consideration. The DEIS does not establish what criteria were considered to measure and analyze changes in quality of life. (200)

Level of Emphasis/Responsiveness

We believe it is important that the analysis address all of the infrastructure elements that provide services. Ignoring significant service providers will distort the results of the analysis.

Social and economic analyses in the DEIS do not discuss county-wide services, problems, issues, or concerns. The counties are an important governing body, primarily responsible for provision of human services, land use planning, roads and bridges, and distribution of funds from federal and state sources. Utilizing the total framework of the existing government entities in the analysis will result in a more useful, accurate document. (130) (200)

GENERAL COMMENTS ON IMPACT ANALYSIS METHODOLOGY

According to the "Final Impact Analysis Guide, Chevron Clear Creek Shale Oil EIS," prepared by Camp Dresser and McKee Inc. for the BLM, Grand Junction, Colorado, "An Environmental Impact Statement (EIS) is a document prepared by a federal agency to disclose the predicted effects of implementing an action, to compare effects of alternatives to a proposed action, and to provide a sound basis for the selection of a preferred action. Central to the completion of a successful EIS is the selection and use of understandable and defensible impact analysis" (emphasis added).





A definitive comparison of alternatives is an important step in accurate impact analysis. This comparison should justify the selection of the agency-preferred alternative based on results of an interdisciplinary analysis of impact descriptions. This type of approach was attempted in this DEIS. However, the presentation of results was often confusing and should be clarified for purposes of comparison.

Impact terminology is a key factor in implementing a common approach to impact analysis. The use of explicitly defined terminology for impact description is imperative. Terms presented in the BLM Environmental Impact Analysis Handbook (BLM, 1981), Landy (Environmental Impact Statement Glossary: A Reference Source For EIS Writers, Reviewers and Citizens, 1979. New York: IFI Plenium) and Alden (Environmental Impact Assessment. A Procedure For Coordinating and Organizing Environmental Planning. Technical Publication No. 10: Thorne Ecological Institute, Boulder, Colorado, 1974) should be used in the discussion of impacts. Without specific definition, the use of words such as "significant," "severe," "not significant," "may affect," "may not affect," etc. does not sufficiently quantify the impact results. If the above-mentioned references are consulted, the "Magnitude of Impacts" could and should be presented in the form of key words such as "High Positive," "Medium Positive," "Low Positive," "None," "Low Negative," "Medium Negative," and "High Negative." Definitions of each of these key words in the text of the DEIS will allow for a more conclusive, consistent, and definitive interpretation of the results. (201)

The presentation of results of the impact analysis would be much more conclusive if the impacts of each alternative were addressed separately. For example, the Alluvial Valleys section had separate subheadings for the No Action, Tract C-11, Tract C-18 and Combined Alternatives. The impacts for each alternative were easily understood. However, the Wildlife section, as well as many of the other sections, did not have individual subheadings that addressed the impacts of each alternative. In addition, a matrix comparing alternatives, disciplines, and impacts would more clearly summarize the impact analysis process. Use of the matrix presentation is specified in the Environmental Impact Analysis Handbook (BLM, 1981).

GENERAL ENVIRONMENTAL IMPACTS

Floodplains

The discussion of flood potential needs further explanations. A table or listing of flood discharges for drainages cited would be helpful in understanding the document. In addition, no discussion or description is presented as to the methodology and criteria employed to assess flood hazard potential.

The floodplains delineated on Figure III-9 are very general due to the map scale. The areas delineated are based on a 100 year flood event, but no discharge values or method of deriving such are provided. This information would be beneficial. (115)

Agricultural Lands

The DEIS suggests that impacts to agricultural lands could be "significant" as a result of increased population and urban development. However, no quantification of "significance" is provided. (202)

Vegetation

There is no explanation why only a worst case analysis is applied in the discussion on vegetation. Moreover, many statements on revegetation are speculative and not supported by the available literature. In addition, it should be noted that assumptions on water table drawdown in the Vegetation section are inconsistent with comparable assumptions made in the ground water section of the DEIS. (203)

Wildlife

The Wildlife section is not formatted consistent with many of the other sections of the DEIS (see General Comments on Impact Assessment Methodology). In addition, several assumptions addressing loss of wildlife habitat under the No Action Alternative are not quantified through presentation of specific data. We feel it is inappropriate to predict impacts without using supporting information to substantiate statements. (98)

Modifications of quantity and quality of habitats of terrestrial vertebrates must be addressed, at a minimum, by describing acreages of each vegetation type, rating of importance of the species, and evaluating modifications of species diversity and abundance as a result of changes in habitat acreages. (167)

Additional comments on the Wildlife sections of the DEIS are as follows:

1. Paragraph 4 on page 149 states that approximately 36,000 acres would be impacted due to ongoing energy development. This statement may be true; however, no supporting data is presented which specifies where the 36,000 acre figure was obtained. The magnitude of impacts concerning habitat loss and the importance of loss of wildlife habitat are not addressed. Loss of certain portions of wildlife habitat may not be as severe as others. For example, loss of critical winter range or calving areas may have more far reaching impacts than loss of a grassy meadow. To state that loss of <u>any</u> habitat (36,000 acres) is significant does not reflect the true nature of impacts. (98)

   Similarly to the discussion above, a quantitative evaluation of acreage and type of habitat lost must be performed in order to accurately assess the impacts (page 149, paragraphs 8 and 9).

2. The DEIS states on page 151 that "An increased number of domestic animals, especially dogs and cats, commonly accompanies this community growth and would result in direct adverse impacts on wildlife populations and distributions." (167)

   To the best of our understanding, the above statement implies that dogs may in fact "prey on" or "disrupt normal behavior patterns" of the wildlife in the area. However, a statement similar to the above







implication is never made. The DEIS should not leave the type or severity of the impact to the discretion of the reader.

3. We believe that "poaching" is inappropriately included as an outdoor recreational activity (page 151, paragraph 10). Perhaps "poaching" merits a separate assessment as a potential impact. (156)

4. In addition, paragraph 10 on page 151 provides no definitive quantitative assessment of the extent of impacts caused by recreational activities. (204)

5. We do not believe the statement on page 151 that "Increases in consumptive use of wildlife would force the Colorado Division of Wildlife to alter future game and fish management strategies. Adjustments in bag limits, length of seasons and/or number of sportsmen participating would be necessary to prevent over-harvest." is supported with sufficient data in the text. (2)

Visual Resources

The methodology used in Chapter III to describe the existing visual resources, while not sufficiently defined, is outdated.

Current methodology, i.e., BLM's Visual Resource Management (VRM) system, should have been used as set forth in Manual 8411, Upland Visual Resource Inventory and Evaluation (BLM 1978). The final Visual Resource Management Classes, as defined by the BLM VRM system, define the degree of acceptable or desirable visual change with the landscape and are derived from the combination of scenic quality, final visual sensitivity, and distance zone data. The results of performing a BLM VRM Visual Resource Inventory will yield 5 class ratings for the subject area, i.e., Classes I through V. In the DEIS, however, only three scenic quality classes were utilized, i.e., Class A, Class B, and Class C. (205)

We understand that the results presented in the DEIS may be the most current analysis performed on the area. However, the evaluation should be performed using the most current BLM methodology. Presentation of the results identified in the DEIS may eventually be misleading and perhaps inaccurate if the most current system of evaluating visual resources is not employed.

Based on the above comments, we believe the impact assessment on visual resources in Chapter IV should be rewritten after the proper inventory is performed on the subject area using the BLM VRM system.

Transportation

The DEIS does not set forth the methodology used to determine the impacts of the various scenarios. At a minimum, we suggest referencing the sources in Tables IV-26 through IV-30.

The discussion on page 10 of the DEIS relating to additional truck requirements for product shipment is overstated since it is planned that syncrude <u>will</u> be transported by pipeline.

### Noise

The References section of the DEIS includes a publication (National Academy of Sciences. 1977. "U.S. Department of Commerce, Guidelines for Preparing Environmental Impact Statements on Noise." Washington D.C. U.S. Government Printing Office) which in our opinion should be used as a methodology guidance document in assessing environmental impacts caused by noise. We can only assume that the methodologies described in this document were used in the DEIS. We are unsure, however, how the impact conclusion was reached with no supporting data. We believe that the impact analysis data results should at a minimum be summarized in the DEIS.

On page 178, paragraph 13, the DEIS states that "Noise levels from operating equipment on-site would be raised from 40-45 db to 80-90 db, at the tract boundary." Baseline data is provided to support the 40-45 db noise level; however, no operating equipment noise specifications are given in the text to support the predicted increase.

No noise isopleths were presented in Chapter IV to demonstrate the difference between existing and projected noise levels. This mapping effort would help support the spatial trends of noise impacts. (2)

### DISCUSSION OF THE ALTERNATIVES

In the description of the No Action Alternative in Chapter II, we question the source of the peak production levels for private oil shale development in the Piceance Basin. Due to the potential significance of the analysis of impacts attributable to the No Action Alternative, we believe it is important to specifically list anticipated production dates and levels for each project included and to identify the sources for the estimates. (167) Moreover, since most of the projects considered in the No Action Alternative have been deferred, the No Action Alternative is not realistic. (4)

In Chapter II of the DEIS on page 27, the 108 acres of topsoil relating to the Multi-Mineral lease is incorrect. It should read "108 acres of total storage including shaft muck and process waste". Furthermore, the 72,000 gallons/day figure used on page 27 is a worst case scenario reflected in Multi-Minerals' mine plan as one possibility (2 wells at 25 gallons per minute maximum). (156)

### MINING METHODOLOGIES

Although mention is made of the possibility of backfilling mined-out areas with spent shale, the DEIS does not address the potential benefits of additional recoveries through mining pillars. Instead, the relatively low extraction ratios likely in mining a deeply buried seam with no ultimate recovery of pillars are stressed. (69)

A very wide variety of approaches to mining the deeply buried oil shale in the center of the Piceance Basin are described in some detail in "A Technical and Economic Study of Candidate Underground Mining Systems for Deep, Thick Oil Shale Deposits" Quarterly, Colorado School of Mines V. 71 No. 4, 1976 by Hoskins, Upadhyar, Bills and Sandberg. The fact that methods described in (19)







this report offer promise of higher extraction ratios was not discussed in the DEIS, even though this report is referenced in the DEIS.

The manner in which open pit mining is casually discussed on page 124 is unrealistic. "Front end" investment is normal on any mining project, both underground and surface mining. In the case of surface mining, the magnitude depends on the stripping ratio. The lower the stripping ratio, the lower the "front end" investment. Therefore, the "front end" investment for a surface mine is not necessarily higher than for an underground mine. It is true that the pit boundaries required to remove 1,000 feet of overburden over 2,000 feet of oil shale would be extensive. However, the successful negotiation of backslope agreements with adjoining landowners (as is commonplace on federal coal leases in Gillette, Wyoming) would allow for the extraction of <u>all</u> the resource within the lease boundaries. (206)

The DEIS overemphasizes poor recoveries of the total in-place resource by either direct underground mining, mine assisted in-situ or true in-situ. However, the resource lost in lower recovery by any of the foregoing methods can ultimately be recovered by a large migrating pit. The statement in Chapter IV that "Proposed plans for a 'migrating' open pit to move through that portion of the Piceance Basin where the overburden is shallow enough to economically recover oil shale, may not affect the lease tracts" is not supported in the DEIS. It is probable that were the tracts mined bv room and pillar methods initially, a large migrating open pit could recover the remaining resource at a very high extraction ratio in the distant future. Therefore, the "permanent loss of resource" described on page 38 is reduced considerably from the 84% to 89% range to an estimated 5% to 10%. (127)

On page 40, sublevel stoping and crater retreat, more commonly called vertical crater retreat (VCR), should be described in more detail. Diagrams are necessary if the methods are to be fully explained.

On page 41, the statement that "Surface facilities consist of permanent shafts encompassed bv large cement head frames" should be reworded to more accurately read: "Surface facilities consist of large concrete headhouses at collars of permanent vertical shafts." (167)

There is an inconsistency in the DEIS between the delivery rate for nahcolite and its annual production from the Multi-Minerals Corporation mine plan, as follows:

$$\begin{array}{ll} \text{Page 122:} & \dfrac{\text{1,670,000 tons/year}}{\text{90 trips/day @26 tons/trip}} = \text{714 days/year} \\ \text{Page 27:} & \end{array}$$

There cannot be 714 days in a year. (155)

### GEOLOGY

The DEIS does not adequately address the relationship of structural geology and specific structural features in conjunction with stratigraphy of the South Rangely Syncline and the Dudley Bluffs Graben. A structural geology map showing these features should be included.

Additionally, the description of location, richness and mode of occurrence of dawsonite, $NaAl(OH_2)CO_3$, throughout the DEIS is not adequately addressed. Instead, dawsonite is discussed in terms of 180,000 tons per acre or a total of 155,000,000 tons. These totals do not indicate whether the mineral is distributed very diffusely through large columns of rock, or whether it is concentrated richly in a relatively thinner zone. This makes a significant difference in its value as a resource and should be addressed in the DEIS. (2)

SURFACE RECLAMATION AND SOLID WASTE DISPOSAL, SOILS

Several of the statements concerning the characteristics of spent shale, reclamation potential of spent shales, and the availability of suitable plant growth material are misleading and not completely accurate. In general, the statements presented are not inclusive of current relevant research results and are, therefore, not presented in the proper perspective.

Additionally, we believe the section on Surface Reclamation and Solid Waste Disposal fits more logically within the analyses of Chapter IV, Environmental Consequences, than in the discussion of the Affected Environment in Chapter III. (6)

Additional comments on these sections of the DEIS are as follows:

1. The statement on page 103, "moderate[ly] high retort temperatures, however, will increase the salinity of spent shale ... ," is not correct. Bloomfield and Stewart (1981) found no relationship between spent shale leachate concentrations of bicarbonate, sulfate, chloride, sodium, calcium, or potassium and retorting conditions.

2. The statement on page 103, "A pH of 8.5 to 9.0 is considered the level that would inhibit plant growth," needs to be put in proper perspective. Many arid to semi-arid rangeland plant species commonly grow in soils with pH values near 8.5. Some species such as greasewood (Sarcobatus vermiculatus) are found in nature growing on soils with pH values near 10 (Rickard, W. H., and Keough, R. F., 1968. Soil plant relationships of two steppe desert shrubs. Plant and Soil 29:205-212). In addition, the pH values of spent shales decrease rapidly when artificially leached or irrigated or when exposed to the weather (Harbert, H.P.,III, Berg, W. A., and McWhorter, D.B., 1979. Lysimeter study on the disposal of Paraho retorted oil shale. EPA-600/7-79-188; Richardson, S. G., McKell, C. M., George, M. R., and Gray, G., 1981. Weathering effects on some chemical and physical properties of processed oil shale. Journal of Environmental Quality 10:221-224). (2)

3. The statements on page 103 regarding leaching of spent shale prior to placement and compaction are impractical. Although the majority of a disposal pile should be highly compacted, the upper portion (3-4 feet) should not be highly compacted so that effective leaching and plant growth would be encouraged. (207)

4. The statement on page 104, "Small plot studies on reclamation of spent shale piles have been made on topsoil depths ranging from 11 to 35 inches (Harbert and Berg, 1978; Redente and Cook, 1981)," is not completely correct. Harbert and Berg (1978), for example, also had zero soil and 6





inch soil depths over spent shale in their experimental design. It should be mentioned that with leaching, irrigation and fertilization, successful vegetation establishment was accomplished on the zero and 6 inch soil over spent shale plots. However, when all the spent shale revegetation studies are considered, it appears that soil covering does enhance revegetation, particularly when the more alkaline decarbonized spent shales are involved. The minimum and optimum soil depths required for any given type of retorted shale are not precisely known. (2)

5. The statement on page 105 that "Topsoil over spent shale piles would eventually erode, exposing spent shale regardless of placement" is only accurate if the erosion rate is greater than the rate of soil formation (including deposition). Several other factors should be considered. For example, steepness of slope, texture of topsoil materials, erosion control measures, etc., are probably more important in terms of potential short-term erosion. There is insufficient evidence available to make such a definitive statement in the DEIS. (208)

6. The statement on page 128, "Temperatures high enough (149°F) to kill roots have been recorded on south facing study plots (Harbert and Berg, 1978)," is not accurate. Such temperatures have indeed been measured on south facing slopes at the dry surface of spent shale (soil surface temperatures were only a few degrees lower) in mid-summer, but temperatures are much lower only a few centimeters below the surface. Plant roots below the surface will not be affected appreciably. Theoretically, high surface temperatures could inhibit germination; however, mulches and irrigation are effective in reducing spent shale surface temperature and have been used successfully to establish plants directly on spent shale following leaching of the spent shale (Harbert and Berg, 1978; Harbert, Berg, and McWhorter, 1979; Berg, W. A., Herron, J. T., Harbert, H. P., III, and Kiel, J. E., 1979. Vegetation stabilization of Union Oil Company process B retorted oil shale. Colorado State University Experiment Station Technical Bulletin 135.) (2)

7. Certain statements on pages 104 and 128 imply that there may only be enough "suitable plant growth material" available on Tracts C-18 and C-11 to cover a spent shale pile with 15 inches of material, while 24 inches is supposedly the minimum soil cover necessary for revegetation. As mentioned in Point No. 4 above, the minimum and optimum cover depths required for adequate revegetation of various types of spent shale have not been established. The evidence available indicates that less soil cover is necessary over lower temperature retorted shales, such as Union B and TOSCO II, than the more alkaline spent shales retorted at higher temperatures, such as Paraho DH, Chevron STB, and Lurgi. The 24 inch recommendation comes from Redente and Cook's (1981) research with unleached Paraho DH spent shale. (94)

In addition to the effect of the type of spent shale, the actual soil depth needed over spent shale depends on the kind of vegetation desired and whether or not the spent shale is leached. Salt tolerant or shallow rooted species generally require less soil cover over unleached spent shale than salt intolerant, or deep-rooted plant species. Proper leaching with water improves the quality of spent shale as a plant growth medium by reducing its salinity and pH. Thus, less soil cover is required over leached spent shale than unleached spent shale. (2)

If, for some reason, it was found desirable to cover spent shale with 24 inches of plant growth medium, it would not be necessary to disturb additional acreage simply to borrow soil. Disturbing areas solely for the purpose of borrowing soil is not only unnecessary but is undesirable because the revegetation potential of the borrowed areas would be reduced. Use of waste rock from mine development and construction plus subsoil and topsoil will provide adequate depths of growth media that are potentially as productive as the undisturbed soils of Tracts C-11 and C-18. (94)

LEASE FORM AND ENVIRONMENTAL STIPULATIONS

1. Oil Shale Lease Form

Preambular Clause

The lease form includes a proposed preambular clause which would subject the lessee to "all regulations hereafter promulgated" by DOI. This provision purports to subject the lessees to future regulation without limitation. BLM should restrict retroactive applicability of the regulations to reasonable nonproprietary regulations.

DOI lacks the authority to amend proprietary lease provisions at will merely by issuing new regulations. The structure of the Mineral Leasing Act demonstrates that Congress intended vested rights under a lease to be invulnerable to defeasance by subsequently issued regulations. The DOI may not rewrite the basic proprietary lease terms whenever and however it chooses, thereby eliminating all stability and mutuality from the lease. BLM should restrict retroactive applicability to reasonable nonproprietary regulations. Such a limitation would not appreciably affect BLM's ability to continually supervise lessees.

If DOI subjects the lessee to all future regulations, such an action could infringe upon private proprietary rights and therefore DOI must compensate the lessee. Some consideration to this concept is given in Section 7(a)(2)(d) of the draft lease. However, the only relief provided is a reduction in royalty payments made by the lessee and then only for environmental compliance and only if the added costs would engender "extraordinary costs" in excess of those in the contemplation of both parties as determined by the lessor. More importantly, the requirement to offset such costs is discretionary to the Department. (209)

Moreover, the implied ability of the BLM to adjust any lessee's obligations is inconsistent with the readjustment provisions of the Mineral Leasing Act and the lease itself. It is clear that Congress has intended that the Secretary would have the power to readjust the proprietary lease terms only at the time specified, i.e., at the end of the 20-year term. This limitation evidences the Congressional recognition that in order to encourage development of public resources by private initiative, a stable relationship between the United States and its lessees must be provided. Unilateral changes of a lessee's obligations, without compensation, are contrary to the public welfare.







Section 4 - Lease Term

Section 4 of a lease grants the lessee the right to mine the federal oil shale for a period of 20 years and so long thereafter as there is production from the leased deposits in commercial quantities. This language is inconsistent with the Mineral Leasing Act which provides that federal oil shale leases may be granted for an "indeterminate period." Since Congress has yet to establish a fixed production deadline for Federal oil shale leases, it is inappropriate for DOI to take it upon itself to do so.

Despite a lessee's best efforts, it may be impossible to bring an oil shale synfuels project on line by the end of the initial 20-year term. Even if development of the lease has been accomplished prior to the end of the 20-year term, the mandate that there be production in "commercial quantities" could prematurely force lease termination.

The scale and complexity of a commercial plant for the development of oil shale may well take over 15 years before construction is completed. Moreover, once the plant is constructed, there will be a degree of uncertainty as to how it will perform. A period of plant shakedown can be expected as equipment is tested, and, if necessary, redesigned. Environmental performance must be monitored and refined and project economics proven. This could add several years to the initial start-up period and prevent achievement of production in "commercial quantities." (210)

Additionally, the estimated costs of a full-scale commercial plant (50,000 BPD oil equivalent) is presently estimated at $3 to $6 billion. The technical risks inherent in the oil shale industry (as evidenced by the recent shutdown or slowdown of several major oil shale projects), coupled with high capital cost, may force companies to plan for phased project development using smaller-scale commercial modules until plant performance can be proven. An oil shale lessee may need to initially construct a module of from 10,000 to 15,000 BPD capacity and subsequently replicate the module after its performance has been commercially proven. Production of "commercial quantities" by the end of DOI's imposed 20-year deadline is unnecessary, unreasonable and incompatible with the multi-billion dollar investments required to put an oil shale lease into commercial production. With the current state of the art, there would probably be a period of time between the initial production of oil shale and the point at which sustained design production rates are achieved. Fixed production obligations during plant start-up would create an unnecessary hardship on a lessee.

Section 7 - Royalties

The draft lease contemplates the imposition of a $.12 per ton royalty indexed if the shale oil content is above or below 30 gallons per ton and adjusted by an increase or decrease of the same percentage as the Producers Price Index for crude petroleum as compared with the Domestic Wholesale Price Index for crude oil. This royalty option has the advantage of focusing the royalty question on the mined ore, not on subsequent retorting or upgrading steps. It eliminates the possible pandora's box of problems which might be encountered in having to back out all costs (including the lessee's return on investment) from the point of first sale back to the mined ore. This methodology is simple and fair and should be retained in the Final EIS and should be considered by the Department when finalizing its Permanent Oil Shale Leasing Program. (119)

### Section 10 - Development Plan and Diligence Requirements

In the draft lease, an oil shale lessee is required to file a mine plan within three years of lease issuance. Since it is highly unlikely that an operator would be able to complete all the necessary work within three years, this requirement is unnecessarily burdensome and unrealistic.

The coal industry is under this burden due to a statutory requirement, but has repeatedly urged DOI to minimize the amount of information required for compliance since little information is available so soon after lease issuance. DOI's recent coal regulation revisions have taken this concern into consideration. In fact, DOI, in its recent testimony on H.R. 5895 and S. 2704 (which would delete the requirement to submit a mining plan within three years for coal leases), strongly supported repeal of the 3-year mine plan submission provision. (211)

Absent imposition of a statutory requirement applicable to oil shale, the proposed mine plan requirement would be needlessly burdensome and unrealistic. Garrey E. Carruthers, Assistant Secretary, Land and Water Resources, at the August 3, 1982 hearing before the Senate Subcommittee on Energy and Mineral Resources on S. 2704, stated that not only did the Department support repeal of the 3-year mine plan submission requirement, but also that "experience has shown it to be very difficult for an operator to do all the work necessary for permitting a new mine (hydrologic studies and the like). . . within three years." If such a submission is "very difficult" for a coal lessee, it would be even more difficult for an oil shale lessee considering the untested nature of this fledgling industry.

### Section 21 - Monopoly and Fair Prices

Section 21 of the proposed lease form entitled "Monopoly and Fair Prices" credits Sections 30 and 32 of the Mineral Leasing Act for authority. Section 30 of the 1920 Mineral Leasing Act provides that the Secretary shall ensure that each lease contains provisions as he may deem necessary to

> . . . insure the sale of the production of such leased lands to the United States and to the public at reasonable prices, for the protection of the interests of the United States, for the prevention of monopoly, and for the safeguarding of the public welfare.

The Mineral Leasing Act authorizes the Secretary to include specific lease provisions to accomplish the purposes enumerated; it does not provide blanket authority to put an open-ended obligation subject to the future whim of the Secretary. The MLA does not empower the Secretary to impose price controls in the future or to review and regulate terms and conditions of sales contracts between the lessee and its purchasers. Additionally, BLM should eliminate at least that portion of the clause which would, by lease contract, permit BLM to retroactively apply price control regulations.

If a national emergency warrants some type of price controls or modification of supply agreements, Congress, if anyone does, rather than DOI, has authority to take action. A federal oil shale lessee should not be singled out as a target for government interference in their sales contracts. (75)





Further, this lease provision potentially jeopardizes the lessee's ability to obtain relief through a force majeure clause in its own private sales contract. If price controls or other government regulations on the oil shale sales are subsequently imposed, the acquiescence by the lessee to the lease clause might negate a force majeure circumstance with respect to its sales contract. Unfortunately, the subsequently enacted laws could be deemed to be "voluntarily accepted" by the lessee so a force majeure clause in the sales contract would not provide protection.

DOI intends to lease the prototype oil shale tracts by competitive bid and no bid can be accepted which is less than the "fair market value" of the oil shale. Thus, before the tract is let, DOI will determine the market value of the oil shale. The bidding systems are designed to capture the "economic rent" referred to as "excess profits." DOI already has potential monopoly powers since it controls prices by the rate at which it releases oil shale to the market and by the extent to which it captures the "economic rent". DOI should not include an open-ended lease provision which seeks the ability to reassess market value determinations after the lease is purchased. The anti-trust laws already protect the public from potential anti-competitive activities by the oil shale industry - we feel it is not an appropriate function of the oil shale lease.

### Section 25 - Overriding Royalties

The proposed Section 25 of the oil shale lease would limit an overriding royalty interest to 25% of the rate of royalty first payable to the United States. For coal, the arbitrary ceiling of 50% is established. There is no reason given why oil shale's limit is half that permitted for coal. The need for this limitation is highly questionable. If the reservation of an overriding royalty interest will not result in a higher purchase price or impede the production of oil shale, there does not appear to be any public benefit or need for such a restriction. (210)

### 2. Environmental Stipulations

Throughout the Environmental Stipulations in the proposed lease, reference is continually made to the discretionary authority of the Mining Supervisor concerning his approval of environmental data collection programs. While we believe it is important for the Supervisor to review, discuss, and mutually modify or adopt a monitoring program to fit the objectives of the study with the lessee, we feel that as the stipulations are now written, excessive discretionary authority is being given to the Mining Supervisor. We suggest the Environmental Stipulations be made consistent in addressing the Supervisor's authority by modifying Section 1(C) to include a statement, such as "Stations shall be established through mutual consent of the lessee and the Mining Supervisor based on need, quality and quantity of data program." (114)

### Section 1(B) - Changes in Condition

Under the environmental stipulations, DOI provides that the stipulations may be revised or amended by mutual consent. Additionally, "the lessor may amend these stipulations at any time without the consent of the lessee in order to make these stipulations consistent with any new federal or state statutes for the protection of the environment upon their enactment and with regulations issued under those statutes." (75)

48

Not even Congress has said that all environmental laws upon enactment are automatically and immediately applicable to existing operations. To the extent that a federal or state law is applicable to ongoing operations, the lease clause is superfluous. To the extent it would eliminate any grandfathering protection normally available under the statute, it is an unauthorized extension of authority and should be deleted.

Sections 6(a) and(b) - Cultural Resources and Paleontological Resources

It is not clear whether or not BLM intends to extend the survey obligation to lands not within the lease boundary. The National Historic Preservation Act does not provide that everything that happened in connection with a federally authorized project, e.g., a federal lease, no matter how remote that connection is to the federal lands, is susceptible to the reach of the Act. Caution should be exercised to ensure that any cultural or paleontological survey obligations are restricted solely to within the lease boundaries. (212)

Section (1)(c)(2)(d) - Flora and Fauna

The text specifies that "daily" movement patterns of fauna must be documented in the monitoring program. We believe that defining daily movement patterns is a requirement that goes beyond the objectives of the monitoring program. Daily documentation of wildlife movement is not overly costly to the lessee; however, it provides little, if any, worthwhile information to the data base. The abundance of data collected for daily year round fauna monitoring, would be confusing. It may be advantageous to monitor daily movement patterns during calving season; however, this should be determined through mutual consent of the Mining Supervisor and the lessee during design of monitoring programs and should not be included as part of the Environmental Stipulations section. (213)



49

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**UNION**

James S. Cloninger
Manager of Administrative Services

September 22, 1982

Mr. John Singlaub
Oil Shale Projects Team Leader
BLM White River Resource Area
P.O. Box 928
Meeker, Colorado 81641

Dear Mr. Singlaub:

We appreciate the opportunity to respond to the BLM Draft Supplemental EIS for the Prototype Oil Shale Leasing Program in Colorado. Our primary concerns, detailed in the attachment to this letter, relate to the disciplines of air quality, socioeconomics, and retorted shale disposal. We believe important inadequacies exist which demand consideration prior to publication of the Final Supplemental EIS. These concerns should also be addressed in the Programmatic Oil Shale Leasing EIS prior to its publication.

Please contact me if you have any comments or questions.

Very truly yours,

Terrence L. Larson

Terrence L. Larson
Environmental Administrator

TLL:tw

Attachment

cc: J. S. Cloninger
D. O. Bender

ATTACHMENT **49**

REVIEW OF DRAFT SUPPLEMENTAL EIS
FOR THE
PROTOTYPE OIL SHALE LEASING PROGRAM

I. Air Quality

Review of the draft EIS and supporting technical air quality report indicates that the air quality impact estimates and statements regarding these estimates are technically unsupportable. In this regard, there are three major deficiencies with the EIS. They are:

A. Summary statements in the draft EIS concerning the air quality impact estimates are misleading to any but the most informed reader.

B. The analysis of air quality impacts is based upon highly conservative estimation procedures (procedures designed to err on the side of overestimation of the actual impact) which taken together do not approximate real, known scientific and empirically based relationships.

C. The maximum impact estimates exceed the concentrations of pollutants emitted at sources potentially contributing to these impacts, and thus the model appears to violate the basic principal of conservation of mass.

Each of these deficiencies is significant alone, but taken together they magnify each other resulting in a large overstatement of the potential air quality impacts.

A fourth, more subtle deficiency of the EIS is the absence of any near source evaluation of the air quality impacts which may be associated with the proposed action (i.e. Prototype Leases). This omission is especially important when examined in the light of previous oil shale air quality impact studies which indicate the potential for significant near source effects (Anderson et al, 1981; Latimer & Doyle, 1981; Latimer, 1982). Because the proposed leases represent a fraction (17%) of the total shale oil development under the highest scenario, the regional evaluation perspective tends to focus on the other existing and planned projects (i.e. no action alternative) while ignoring potentially significant near source effects of the proposed action, individually and cumulatively. (214)

Each of the above three major areas of concern is discussed in greater detail below.

A. Draft EIS Conclusions

The discussion on page 3 of the draft EIS under "No Action Alternative" leads the reader to believe that efforts have been made to not "exaggerate or underestimate" the actual impacts. In fact, in the air quality modeling, decisions were made which were recognized to be conservative. This conservative approach to the impact assessment should be stated prior to presenting the actual model estimates. (4) (156)



The discussion on page 4 on growth in Rifle followed by air quality impacts in Rifle leads the reader to wonder if the air quality impacts result from population growth. In fact, the air quality estimates are based on modeled plume impacts from planned oil shale developments, which appear to be inaccurate (see discussion of item 3). (4) (34)

Also in this same discussion, as elsewhere throughout the EIS, 24 hour maximum $NO_x$ concentration estimates are compared with the annual average $NO_2$ National Ambient Air Quality Standard (NAAQS). The inference is that the 24 hour maximum exceeds the annual standard by such a large value that a standard exceedance and adverse health effects would result. While the model estimate appears unreal, as will be discussed later, the relationship between maximum $NO_x$ and annual $NO_2$ concentrations needs explanation. Two factors make the direct comparison inappropriate.

- Only a portion of the $NO_x$ emitted from the sources will be $NO_2$ (maximum between 0.76 and 0.93; EPA, 1980). (83)
- Maximum ground level pollutant concentrations from point sources averaged over a year will be only a small fraction of the 24 hour estimate (between 7 and 4%; Montgomery and Coleman, 1975).

These relationships are supported by empirical evidence and must be factored into any comparison of short term $NO_x$ estimates with the long term $NO_2$ standard.

Statements in the summary and air quality impact sections of the draft EIS indicate that based on the model results Prevention of Significant Deterioration (PSD) Class I $SO_2$ increments (24 hours) will be exceeded at Mt. Zirkel Wilderness. It should be pointed out in the EIS that this result is based solely on the modeling of emissions from the existing Craig power plant. Since the emphasis of the draft EIS is on oil shale development, the reader is led to believe that this impact estimate is due to the overall development of the region. (31)

Also, it should be made clearer that the impact estimates at Book Cliffs are solely attributable to modeling of emission from the proposed Southwest Power Plant.

On page 9 of the draft EIS it is indicated that air quality would "deteriorate significantly in Rifle, near the Book Cliffs and within Mt. Zirkel Wilderness Area.". This statement as in similar statements in the air quality section does not recognize the conservatism, and thus uncertainty with which this prediction is made. For example, even if the assessment were accurate, exceedance of Class I PSD increments under a single worst-case condition does not necessarily imply significant impact of important AQRV's at the Mt. Zirkel Wilderness. Consideration of frequency and seasonal variability along with the degree of impact are recognized as important factors in determining significance. (9) (32)

It should also be pointed out that the model results used to indicate significant impacts at Class I areas are not in close agreement with other recent studies which have attempted to estimate the potential constraint to growth of the oil shale industry. Estimates of the maximum oil shale production rate which could be accomodated before PSD Class I increments are approached or exceeded range from greater than 1 million barrels per day (bpd) (Anderson et al, 1981) to approximately 900,000 bpd (Williams and Manging, 1980; and Latimer and Doyle, 1981) to 579,000 bpd for this Prototype draft EIS. Each of these studies have employed conservative modeling principles in estimating class 1 effects, with the Prototype EIS study being the most conservative of all. Also, the recently released study for BLM's Uintah Basin Synfuels DEIS (Latimer et al, 1982) which contains the most comprehensive and realistic modeling approaches used to address this problem to date indicates that Class I increments will be amply protected at the 1 million bpd shale oil production level. (247)

B. Extreme Conservatism of Modeling Approach

It is recognized that due to the inherent uncertainty of present day air quality models, especially when applied to complex terrain and long transport distances (greater than 50 km) such as in the this case, conservatism in assumptions is justified in order to protect the air resource. However, the modeling approach used to estimate impacts for this draft EIS appears to have selected conservatism over realism in all aspects of the effort and thus has unnecessarily compounded the conservatism of the analysis. The principal areas of concern are the assumptions made regarding plume transport and dispersion. The following items are seen as major weaknesses of the analysis for which the use of conservative assumptions has resulted in a large overstatement of the potential air quality impacts.

- The model used to estimate TSP, $SO_2$ and $NO_x$ concentrations assumed a constant wind field (i.e., not straight line, but non varying) over a 24 hour period. This approach ignores diurnal influences on plume transport which act daily to transport pollutants emitted in the first several hundred meters of the atmosphere downslope during the night and early morning and upslope during the daylight hours after the inversion has lifted or broken up. The dominance of this transport phenomenon has been observed repeatedly and is fundamental to estimating pollutant transport in complex terrain. The non-varying transport condition assumes that winds will be channeled and diverted by terrain in a constant manner to a single point of maximum impact, during both daytime surface heating and nighttime surface cooling conditions. This is an unrealistically conservative assumption which is not necessarily better than the straight line transport assumption which is recognized as inappropriate for complex terrain situations. In addition, straight line transport models gener- (144)



ally recognize that the plume will meander due to frequent small shifts in wind direction, and this dispersion effect is accounted for by sector averaging. Plume meander is apparently ignored for the purpose of the draft Prototype EIS impact assessment.

- The draft EIS results are based on highly conservative and unrealistic assumptions regarding atmospheric stability, plume dispersion and mixing depth. Based on review of data collected in the oil shale development region (Anderson et al., 1981) stable atmospheric classification over an entire region and day, even a worst-case day, is not realistic. A mechanically induced turbulence would be a neutral atmosphere during the mid-morning and afternoon hours and stable conditions at night. This diurnal change is critical to an evaluation of Class I area impacts since pollutants are only likely to be transported in an easterly direction from the oil shale development region to Class I receptor areas during daylight hours. (79)

  Use of the Pasquill dispersion coefficients, while often used, adds further to the conservatism of the results by ignoring terrain induced turbulence. Use of a constant average mixing height may unrealistically affect results at long transport distances by trapping plume dispersion. This average mixing height is much lower than would be expected during the daylight hours when transport of emissions towards Class I areas can occur.

- The visibility analysis performed for the draft EIS is based on the EPA Level 1 screening approach. Since this is a recognized conservative procedure to be used only to exclude the possibility of significant visual impairment, a level 2 analysis must be performed (as a minimum) once the level 1 results show significance. This procedure is important in that there are basic local/regional input data required for the level 2 analysis which are assumed to be the absolute worst-case in the level 1 analysis. The level 2 inputs, which are derived from the study area data, to define local or regional worst-case conditions include:

  - wind speed
  - atmospheric stability and mixing depth
  - time of day and season
  - background ozone concentrations
  - background visual range
  - persistence of meteorological conditions
  - topographical effects on plume transport and diffusion (140)

  Use of regional input data and the level 2 analysis is not beyond the scope of the EIS if, in fact, an estimate of visual effects specific to the source region is desired.

The visibility results as presented in the draft EIS are generic worst-case and should not be used to provide the general public with an estimate of the effects of the proposed and alternate actions.

- Estimates of acid deposition are based on the assumption that the maximum single point $SO_2$ and $NO_x$ concentrations estimates at Class I areas is representative of the levels across the area when corrected from 24 hour to annual average conditions. This assumption is very conservative given the modeling approach and multitude of transport trajectories which can occur over a year for the long transport distances between source areas and receptors. Another assumption that a 5:1 ratio exists between 24 hour maximum values and annual averages is apparently based on data for urban areas as reported by Larsen (1973) and should not be used for rural point source related impacts. Because of the fundamental differences in the distribution of urban versus rural point source emissions, the 24 hour to annual average ratio would be much greater than the 5:1 ratio, especially at the long transport distances involved. (215)

Overall, these approaches result in estimates which when presented in the draft EIS without sufficient explanation of their uncertainty and conservative underpinning provide a misleading picture of the air quality effects of both the proposed and alternative actions.

C. Evaluation of Model Results

Based on an evaluation of the initial plume concentrations and the resulting downwind maximum concentrations, it appears that the model estimates do not conserve mass, a basic law of physics. This evaluation is presented below.

The maximum TSP, $SO_2$ and $NO_x$ concentrations at Rifle are the highest estimated in the region. Due to the location of sources and downwind pollutant ispoleths, it appears that the model has estimated these concentrations from the interaction of emissions from sources located in the Parachute Creek, Roan Creek, and Upper Piceance Creek drainages. An evaluation of X/Q values using emission estimates from these sources and the maximum 24 hour concentrations at Rifle for the no-action alternative tends to support this conclusion.

Using the initial plume dispersion assumptions ($40_y$ and $40_z$) and a 4 meter per second wind speed, the initial plume concentrations for each pollutant at the source can be calculated. Based on second law of thermodynamics (which requires that the entropy of a system is always increasing), the peak plume concentrations must decrease as it is blown downwind. Thus, the maximum downwind concentration cannot be greater than the sum of the initial plume concentrations for all sources causing the impact. (61)



In Table 1, the initial plume concentrations for all sources potentially contributing to the maximum impacts at Rifle are presented. The sums of these initial concentrations are also given in this table. Comparison of these totals with the estimated maximum impacts at Rifle indicates that the impact exceeds the initial concentration by a factor of approximately 2 and 4 for the west and northwest wind directions, respectively. It appears that the model is violating the conservation of mass principle by an incorrect buildup of puffs at the point of maximum impact. If so, these results are not only conservative but mathematically incorrect.

II. Socioeconomics

The socioeconomic impact assessment of the proposed prototype leases lacks adequate documentation of assumptions and methodologies. Primary among the inadequacies is the lack of supporting information for the baseline development scenario. The DEIS indicates that seven projects constitute the baseline; however, no project specific employment or production figures are provided. Provision of these figures is critical for evaluation of the cumulative impacts. In light of recent developments in the oil shale industry, a seven-project baseline is extremely optimistic. (36)

Conclusions regarding the magnitude of negative socioeconomic impacts are drawn without citing or referencing any supporting assessment data nor documentation of methodologies or models employed. The discussions of population-related impacts are repeatedly presented in percentages without quantification of absolute impacts. Magnitude of impacts is also discussed in qualitative rather than quantitative terms (e.g. "moderately severe, very severe"). Comments such as "hiring of professional planners is strong evidence (of formalized local decision-making)" exemplify the use of anecdotal rather than empirical data. (130) (216)

Table IV-18, in the DEIS, presents a summary without source of potential social impacts resulting from rapid population growth. No documentation or analysis is provided to support these conclusions. Further, it is unclear whether these potential impacts are applicable to the prototype leases. No consideration is given to the considerable amount of excess capacity and planned capital construction among the jurisdiction in the impact area. (5)

The DEIS lacks proper documentation of a baseline production scenario, assumptions, methodologies and quantification of impacts. Empirical analysis should replace unsubstantiated qualitative conclusions of potential socioeconomic impacts. Without explicit, quantitative documentation of these concerns, the conclusions drawn will be misleading and likely inaccurate.

TABLE 1

Comparison of Initial Plume Concentrations
with Maximum Impact Estimate at Rifle
(No-Action Alternative)

| Source | Initial Plume Concentrations (ug/m³) TSP | $SO_2$ | $NO_x$ |
|---|---|---|---|
| Colony | 10 | 58 | 52 |
| Union | 115 | 103 | 667 |
| Mobil | 60 | 58 | 370 |
| Chevron | 120 | 115 | 740 |
| Cathedral Bluffs | 107 | 93 | 555 |
| Total All Plumes | 412 | 427 | 2384 |

| Synoptic Wind Direction | Maximum Impact Estimated (mg/m³) TSP | $SO_2$ | $NO_x$ |
|---|---|---|---|
| West | 704 | 865 | 4100 |
| West-Southwest | 361 | 352 | 2223 |
| Northwest | 1671 | 1625 | 10308 |





III. Surface Reclamation and Solid Waste Disposal

This presentation of retorted shale properties, reclamation, and associated problems fails to consider relevant research, in addition to alternative design measures, controls, and mitigation measures which will commonly be utilized. As a result, a misleading picture of the problems associated with retorted shale disposal is presented.

Apparently, two assumptions underlie the analysis: that carbonaceous retorted shale is far inferior to decarbonized retorted shale for reclamation, and that compaction to density of 100 pounds per cubic foot is both feasible and essential. First, the stability of any disposal system is insured only by adequate design and construction, and is not dependent upon any one property such as the natural cementation qualities of decarbonized shale. Instead, emphasis should be placed on proper siting, control of surface and groundwater in the vicinity of the retorted shale, and consideration of the unique properties of retorted shale from various retorting methods in the design of a stable disposal system. The concerns over stability, permeability and seepage should be addressed within this overall context. (217)

Secondly, no analysis is provided supporting the implication that 100% compaction throughout each retorted shale pile will prevent the problems of seepage, leachates, and stability while any lesser compactive results will result in those problems. Lacking a comprehensive risk/benefit analysis, this stringent standard seems arbitrarily set and unsupported. (218)

On page 102 under Permeability and Seepage in Spent Shale Disposal Piles, Paragraph 3, it is assumed that a system of liners, drains and catchment basins, to collect leachates from retorted shale piles, is feasible. Neither the necessity for the measures nor their feasibility are substantiated. (219)

On page 103 under Underground Shale Disposal, the statement is made that 75 to 85 percent of the retorted shale could be placed back into the mine. Our information indicates that only 20 to 50 percent of the material can be placed back into the mine. Although this procedure is attractive in that it could increase recovery, it should also be noted that underground disposal is not proven and is considered to be in the experimental stage. Hydrologic and water quality considerations, control of particulates in the mine during transport and placement, and temperature control must all be considered in underground disposal. (39)

Inadequate consideration has been given to alternatives for above ground shale disposal. Successful establishment of plants directly on carbonaceous retorted shale following leaching has been demonstrated (Harbert and Berg, 1978; Harbert, Berg, and McCorter, 1979; Berg, Herron, Harbert, and Kiel, Vegetation Stabilization of Union Oil Company Process B Retorted Oil Shale, Colorado State University, Experiment Station Technical Bulletin 135, 1979). (2)

While soil cover enchances early establishment of vegetation, the studies referenced above have shown that revegetation on retorted shale with 0 to 6 inches of soil can be successful. Also, contrary to the assumption that establishment of shrubs will not be possible under these conditions, shrubs established on the referenced Union Oil CSU revegetation plots are now the dominate species present. Finally, assumptions on the negative effects of high temperatures on carbonaceous retorted shale surfaces ignores alternative treatments such as mulching, irrigation, and the timing of planting. Therefore, high surface temperatures on carbonaceous retorted shale should not be presented as a problem which prevents revegetation. (226)

IV. Committed Mitigation

It appears that stringent and arbitrary wildlife mitigation measures will be imposed without the support of site and project specific impact analyses. Imposition of committed mitigation measures such as the restriction of "human disturbances" during winter months should be imposed only if significant adverse impacts will be unavoidable due to the activities of a specific project, and when these impacts cannot otherwise be mitigated. (66)





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RICHARD M LIEBER
PRESIDENT

September 21, 1982

Mr. John Singlaub, Team Leader
Bureau of Land Management
White River Resource Area
P.O. Box 928
Meeker, CO 81641

Subject: Comments on Draft Supplemental Environmental Impact Statement (DEIS) for Prototype Oil Shale Leasing Program (47 FR 31080, July 16, 1982)

Dear Mr. Singlaub:

Rio Blanco Oil Shale Company appreciates the opportunity to comment on the above-referenced DEIS. Our comments (attached) deal most specifically with the air quality and hydrology elements of the DEIS. However, comments are also provided that deal with waste disposal, monitoring, and threatened/endangered species.

The DEIS presents in many instances an overly conservative analysis and a resultant overemphasis of potential deleterious impacts. The inclusion of additional information or statements to clarify and to qualify the analysis is thus needed to provide a more realistic perspective for your decision-making purposes.

If you have questions regarding these comments, please contact Dr. G.E. Bertolin (303/695-2484).

Sincerely,

R.M. Lieber

GCS:mjr

Attachments





ATTACHMENT

COMMENTS ON DRAFT SUPPLEMENTAL EIS FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM (47FR31080, JULY 16, 1982)

## AIR QUALITY

The primary comment concerns the results of the air quality simulation modeling done for the Draft EIS. The modeling predicts that the NAAQS for $SO_2$ and TSP will be exceeded, the maximum 24-hr $NO_x$ value will be 41 times the annual Ambient Air Quality standard for $NO_2$, and that the Class I increment for $SO_2$ will be exceeded at the Mt. Zirkel Wilderness Areas. This senario is identical for the No Action Alternative (no new federal leasing) as well as the year 2003 High Production Scenario. In addition, the High Production Scenario for 2003 is also predicted to result in violations of the Class I $SO_2$ increment at the Flat Tops Wilderness Area.

These results are certainly surprising, for no other modeling efforts have predicted so many violations of so many standards. Another recent study done for the BLM (SAI, 1982), combining both Uinta and Piceance Basin pollution studies, predicted a "small, but nonzero probability" that PSD Class I $SO_2$ increments at Flat Tops and Mt. Zirkel Wilderness Areas would be exceeded. The Class II increments for TSP and $SO_2$ near the oil shale facilities would be approached, but not necessarily exceeded. No NAAQS are predicted by the SAI study to be exceeded due to direct emissions from oil shale facilities. (247)

The discrepancies between modeling results are not easily rectified, due to varying assumptions and approaches used by the workers. However, the results can be evaluated for reasonableness. When this is done, a number of concerns about the model used in the Draft EIS become apparent:

A. Wind Field Modeling - This is critical to the overall results, since the major factor governing dispersion of the individual plumes is horizontal transport by the winds. Both the interaction between plumes and points of maximum concentration are determined primarily by the wind flow pattern. Consequently, The WINDS model used in this analysis deserves

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close scrutiny. Unfortunately, the output from WINDS is entirely a set of wind vectors predicted by the model - no actual monitored wind data is used in the model. The model calculates the wind field in two steps:

a) adjusting the background wind (which is arbitrarily defined) to account for major terrain features

b) modifying the wind field to account for pertubations caused by the actual terrain and thermal and frictional factors.

This is accomplished by using simplified theoretical approaches.

A major concern with the theoretical approach used in the WINDS model is that steady state conditions are assumed (Dietrich, 1981). That is, the flow field is assumed to be invariant with time. This approach ignores the diurnal variation which is a significant factor in boundary layer flows in complex terrain. A complete reversal of flow direction (and hence greatly increased plume dispersion) is often observed in complex terrain. Consequently, the steady state conditions assumed by the model are not likely to occur (especially under the atmospheric conditions assumed here: 4 m/sec wind at 10 meters and "E" stability), thus the 24-hr predicted impacts appear to be unrealistically overpredicted. (33) (144)

This model, then, develops an abstract wind field based upon theoretical principles which is used to estimate air quality impacts, without ever being validated in the Piceance Basin. The model did undergo preliminary validation in San Diego County in California. However, this model validation was carried out using only one data point per day (at 1 pm), and thus completely missed the important diurnal effects discussed above. We feel that it is inappropriate to compute worst case 24-hour impacts in the Piceance Basin with a steady state model that has been only partially validated in another part of the country using a very restricted data set.



403

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Even under long-term conditions, however, the state of the art modeling is such that the complex terrain in the Piceance Basin may easily cause major differences between theoretical principles and actual wind flows. At an American Meteorological Society Conference on Mountain Meteorology in 1981, it was generally agreed that the scientific understanding of the problem of flow in complex terrain was poorly understood, partly because of a severe lack of data. As an example, one investigator studying noctural flows near Tract C-a (Barr and Clements, 1981) found an unexpected easterly flow embedded in a generally westerly flow pattern. This easterly flow, located within 100 meters of the surface, would completely invalidate any air quality dispersion modeling, since it is unaccounted for in current models. The authors state that this "... offers a warning about postulating air quality projections without an adequate basis of measurements".

If the wind field flow patterns in the air quality technical report (Figures 2-6 through 2-10, Dietrich et al., 1982) are closely examined, the cause of the abnormally high air quality impacts near Rifle become apparent. Particularly under conditions of WSW, W, and NW background winds, an area of convergence of winds from all directions occurs just west of Rifle. Consequently, the model predicts very high air quality impacts due to this anticipated zone of convergence. Other areas (such as Craig), which do not have a zone of convergence, have predicted air quality impacts at least an order of magnitude less than the impacts at Rifle. It should be emphasized that this zone of convergence has not been measured, only predicted by the air quality modeling. In fact, it is highly unlikely that this zone of convergence is a steady state condition that is maintained 24 hours per day as assumed by the model. Until this phenomenon has been verfied, the modeling results must be highly suspect. (33) (144)

B. Reasonableness of Results - Evaluation of the modeling results reveals another precularity: under a "northwest influencing" wind, the wind field modeling shows that pollution from the C-11 and C-18 leases would be transported directly toward Rifle, yet there is no increase in air quality impact between the No Action Alternative and the Year 2003 High

Scenario. This is predicted despite a production increase from the No Action Alternative of 379,000 bbl/day to the 2003 High Scenario of 819,000 bbl/day, an increase of 70 percent. Since the increased production (and emissions) all occur near the C-11 and C-18 leases and the WINDS model predicts that the emissions will be transported directly towards Rifle, how can there be no additional impact? Where does the pollution go? Apparently, the zone of convergence just west of Rifle prevents any impact at Rifle from the additional 340,000 bbl/day of production. These results simply do not seem to be realistic. The model must be verified and validated before these results can be relied upon. (31) (33) (35)

C. Confidence In The Results - The recent air quality impact analysis done for the Uinta Basin (SAI, 1982) presented ranges for predicted air quality impacts. This seems to be a reasonable approach, given general agreement that air quality modeling is accurate within a factor of two in flat terrain, and probably much less in complex terrain. Why then does this air quality analysis present results to four and five significant figures? Apparently, the authors have not carefully evaluated their work and tested it for reasonableness. (82)

D. Stability Class - In the report, the impacts are determined for the 24-hour standards and increments, since these are expected to be continuing. It seems unrealistic to assume an "E" stability for 24 hours, especially since the Uinta Basin study (SAI, 1982) assumed a "D" stability. (80)

E. Visibility - The air quality analysis includes a Level-1 visibility analysis. The problem is that a Level-1 analysis is inadequate as a diagnostic tool for predicting visibility impacts. It is designed only as a simple, quick screening tool to eliminate these sources that obviously will not cause visibility impacts. A Level-1 analysis does not provide sufficent information for decisions to be made on this EIS.

More importantly, predictive visibility modeling has been shown to be very inaccurate. The American Petroleum Institute recently funded ERT (140)



404



to do an evaluation of visibility models (ERT, 1982), which showed that present methods yield predictions that are essentally unrelated to measured values. This study also showed that two commonly used methods yield visibility predictions that differ by a factor of 4 or more.

F. Atmospheric Deposition - The EIS presents predicted deposition values, yet no screening or analytical model has yet been suggested by EPA, let alone verified. In addition, the predictions are presented with no interpretation or reference values in order to provide some means of attaching significance to the estimates. The values presented here are approximately the same as given in the Uinta Basin study (SAI, 1982), which concluded that the effects would likely be minimal. (7)

G. Increment Consumption at the Flat Tops and Mt. Zirkel - The modeling parameters assumed for this study include a 4 m/sec background wind at 10 meters and "E" stability for 24 hours. This choice of "E" stability, as indicated above, is too conservative - a "D" stability choice would be more realistic, especially over a 24-hour period. However, if "E" stability is chosen, then the wind field diagrams appear to be in error (Figures 2-6 through 2-10). Specifically, under light winds and stable atmospheric conditions ("E" stability), typical of nocturnal drainage conditions, there should be a relatively deep easterly wind flowing down from the Flat Tops and Mt. Zirkel area to the Piceance Basin. Consequently, the plumes from oil shale facilities would probably never reach the wilderness areas under "E" stability conditions. The points to be made here are:

1) The actual regional wind field could differ by 180° at some locations (see Barr and Clements, 1982) from simplified theoretical calculations. There is virtually no data to verify or reject almost any wind field prediction that might be made. (80)

2) Given these uncertainties, there is no justification in providing calculations of increment consumptions to three significant digits - the results may easily be off by an order of magnitude. A set of error bounds would be more reasonable (SAI, 1982). (82)

3) The selection of atmospheric stability is too conservative.

Summary on Air Quality Analyses

One of the major concerns, which will have a significant effect on the impact analysis, is the wind field modeling. As discussed above, there are at least two locations where the results are highly suspect. There is no discussion of the reasonableness of the results, nor of tests to determine the sensitivity of the model to changes in input parameters, i.e., changes in the grid size used in the model. The zone of convergence predicted near Rifle is the apparent cause of the extremely high concentrations estimated there, yet no monitored data or validation techniques have been used or are available to prove that this analysis is more accurate than others which have not shown this impact. Based on these uncertainties, providing what appear to be very significant and accurate results on the basis of unvalidated prediction techniques is highly misleading and inappropriate for inclusion in an EIS.

HYDROLOGY

The uncertainties of modeling the complex hydrologic systems in the Piceance Basin need to be addressed in more detail in the DEIS. The models employed are largely invalidated and little use is made of existing data, such as on current mine dewatering operations. The need exists to deal with model uncertainties in a manner to provide a realistic perspective for interpretation and decision making.

A. Groundwater

1. The EIS indicates that the hydraulic heads of upper and lower aquifer are nearly equal at C-11 and C-18. In another location, the EIS indicates that flow is from lower to upper aquifer through the Mahogany Zone. This apparent inconsistency should be clarified as it is key to site-specific ground water impacts such as aquifer mixing. (2)







2. The plot of groundwater levels during operation (dewatering) shows flow potential from upper to lower aquifer. Thus impacts on the relatively good quality water in the upper aquifer would not be expected during operation.

3. For the effects of dewatering, it would be better to draw on the experience of actual operations at Tract C-a and C-b than on Taylor's model. The grid size of this regional model is inadequate for site specific analysis such as dewatering at the proposed new lease tracts. (135)

4. Page 134 includes projections of TDS changes due to dewatering on Tract C-b. Since dewatering has occurred on Tract C-b (and Tract C-a), actual data should be compared to the model projections in order to validate the model results. Without such validation the model results cannot be substantiated. (221)

B. Surface Water

1. Page 133 indicates increased channel erosion and degredation as evidenced on Tracts C-a and C-b. The extent and nature of this "degredation" should be more explicitly substantiated (i.e. data need to be presented). (2)

2. Page 137 (surface water quality - no action alternative) references Table III - 10 as showing impacts on surface water. This should be Table IV - 10, as Table III - 10 deals with employment and income. (6)

3. The EIS describes impacts on Yellow Creek which may become dry over 50 percent of the time. Sections of Yellow Creek are now dry at times. The water near the confluence with the White River is saline (conductivity 3000-4000 micromhos/cm) with very limited aquatic habitat and no fishery. The impacts of development on such a system are unclear. (155)

4. The rationale for selecting 1951 as a period of "normal" flow (pg 137) needs to be presented. Normal is usually defined in a statistical manner. Also the backup data for projected water use on Tract C-a is needed. (199) The listed use projection (6K acre-ft in 1988, 8K acre-ft in 1993 and 16K acre-ft after 2000) is probably inappropriate. (152)

5. On page 137, flow reductions in the White River are labeled as "insignificant". The following sentence: "However this water would be lost for other uses, such as agriculture." is similarly insignificant and should be deleted.

6. Projected flow reduction are based on total water supply (4 bbl/bbl oil) from the White River. The mine dewatering analysis does not include reinjection or discharge (the water is gone from the system). Pumped groundwater will be used or discharged, either of which would reduce depletion. The facility water balance presented in the EIS may be misleading.

7. Page 137 indicates that most stream depletions will occur in the initial years. It should be noted that during the initial segment of site development, dewatering operations will likely produce a surplus over consumptive needs. Thus depletions (and related quality changes) are not likely to be as great as projected.

C. Spent Shale Disposal

1. The evaluation of impacts of surface processed shale piles cannot be accomplished without due consideration to rates of leachate production. Test plots of soil, over spent shale on Tract C-a indicate water penetration of only about 70 cm. The plot has produced no leachate over the 7-year study period. (2)

2. The utility of the analysis by Robson and Saulnier (1981) to discuss impacts is unclear. The report deals with potential effects of in situ spent shale leaching at Tracts C-a and C-b. (151)





Although C-a has not abandoned this approach entirely, it is not the current primary approach due to potential for enhanced resource recovery from open pit mining with surface retorting.

MISCELLANEOUS

1. Threatened and endangered species - The reference made to whooping cranes and peregrine falcons relates to sightings during baseline studies on Tract C-a. During these studies, incidental sitings of one whooping crane with greater sandhill cranes and one peregrine falcon occurred. These individuals were apparently migrating in the vicinity of Tract C-a. Rio Blanco evaluations show that this area does not provide critical habitat for any state or federally endangered species.

2. It is not clear that in situ retorts will be governed under the UIC program as indicated on page 134. It is also unclear how additional groundwater data will assist in determining "how these new regulations will affect groundwater systems of Piceance Basin". Regulations do not affect natural systems at all. (2)

3. The discussion of construction impacts should include a statement that erosion/sediment control structures are required. Thus a greatly increased loading is not anticipated. (155)

4. The discussion of process water is incomplete. The fact that it will be produced and that it contains inorganic and organic constituents does not lead to potential impacts. Water treatment and reuse needs to be discussed. (2)

ENVIRONMENTAL STIPULATIONS

1. Stipulation of drainage and collection system below piles. As such systems will always fail in some time frame without continuing maintenance. Since continuing maintenance ad infinitum is infeasible, this (219)

stipulation is not reasonable nor is such a design likely to be approved by the Colorado Mine Land Reclamation Board.

2. In a somewhat similar fashion, the stipulation for lined impoundments is only applicable to operational phases and is not feasible for the longer term. (100)

3. Deep aquifer wells are inappropriate for monitoring of surface disposal piles and surface impoundments in this area. A realistic anticipation is for long term, low level releases from surface disposal piles. The time frame to reach deep aquifers, penetrating the pile, several hundred feet of Uinta Formation and confining beds of artesian aquifers, make deep aquifer wells most inadequate for monitoring. The time to response at monitoring sites is too long and too uncertain and the likelihood of mitigation at that time is small. (222)

   The more appropriate monitoring should be focused within and adjacent to the pile and perhaps adjacent alluvial systems.

   Deep wells are more appropriate for monitoring effects of mining or in situ development.





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SAI, 1982: Air Quality Impact Analysis of Synthetic Fuel Development in the Uinta Basin, Final Report, to Bureau of Land Management, Salt Lake City, Utah.

51

United States Department of the Interior

GEOLOGICAL SURVEY

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WATER RESOURCES DIVISION
MEEKER SUBDISTRICT

September 21, 1982

Memorandum

To: John Singlaub, Bureau of Land Management, Meeker, Co.

Via: Subdistrict Chief, U.S. Geological Survey, WRD, Meeker, Co.

From: Frank Welder, U.S. Geological Survey, WRD, Meeker, Co.

Subject: Comments on Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program 1982

On page 39 is the statement that "as a result of mine dewatering Yellow Creek will become dry over 50 percent of the year. Also Piceance Creek would experience periods of no flow in the summer." This opinion is based on earlier assumptions that ground water in the bedrock aquifers (Uinta and Green River Formations) is, throughout the basin, directly connected to the valley-fill material in Piceance and Yellow Creeks, to the flow in the creek channels, and to the springs in the creek valleys. Unfortunately these assumptions have not been verified except at the extreme upper and lower reaches of the two creeks.

Our most recent study of the hydrologic relationship between the bedrock aquifers and the valley-fill material, springs, and creek channels, has been in the valley of Yellow Creek in sections 1 and 2, T.1S., R.98W. where a large spring flows about 250 gallons per minute from the western edge of the valley. We drilled six test holes through the valley-fill material. Due to a shortage in funding, we have not completed the site study, but geologic evidence from other locations in the basin indicate that some springs flow from the valley-fill material and not from the bedrock aquifers. Thus dewatering the bedrock aquifers in these areas may have little if any effect on ground water in the valley-fill material, on the flow from the spring or the flow in the channel. (251)

51



We have geologic evidence that these conditions exist in both Yellow and Piceance Creeks. We would like to pursue this further. The legal and technical implications are clear and very significant.

Frank Welder

Copy to: Tom Major, WRD, Lakewood
O.J. Taylor, WRD, Lakewood
Bill Van Liew, WRD, Meeker
District Chief, WRD, Lakewood

52

**American Petroleum Institute**
2101 L Street, Northwest
Washington, D.C. 20037
202-457-7000

RECEIVED
Bureau of Land Management
Meeker, Colorado

September 21, 1982

Mr. John Singlaub
EIS Team Leader, White
River Resource Area
U.S. Bureau of Land Management
P. O. Box 928
Meeker, CO 81641

Dear Sir:

The American Mining Congress and the American Petroleum Institute, through their respective Synthetic Fuels Committees, appreciate the opportunity to comment on the Draft Supplemental Environmental Impact Statement (DEIS) for the Prototype Oil Shale Leasing Program (47 FR 31080, July 16, 1982).

The purpose of the DEIS as we understand it is to examine the site specific and potential cumulative impacts of leasing up to two additional prototype tracts under the original 1973 Prototype Oil Shale Leasing Program. While there are numerous comments that could be made if time permitted, we believe that DEIS is seriously deficient in at least three areas: air quality, hydrology and socioeconomics.

Additionally, it is our understanding that the EIS for the long-term Oil Shale Leasing Program is being prepared concurrently with the subject EIS and that the Programmatic EIS will use much of the same baseline information and assumptions as the prototype supplemental EIS. It is our concern for both programs that prompts our overview comments. We expect that individual companies will submit more detailed comments.

Air Quality

The analysis in this section is based upon unrealistic assump-
tions and unvalidated models, which results in erroneous (33)
conclusions. For instance, the assumption of wind persistence (81)
in a given direction for 24 hours is extremely conservative and (144)
not representative of available data. We would be pleased to assist in obtaining technical assistance from industry specialists in order to establish a more realistic assessment of air quality impacts.



52



The DEIS concludes that serious air quality violations would occur in the baseline or "No Action Alternative" which includes all of the development and land uses reasonably anticipated for the region in the foreseeable future but not additional federal leasing. Since development levels will be controlled by the PSD permitting process, this implies that the responsible agencies, (1)
EPA and Colorado Department of Health, would issue permits that would result in violations of the NAAQS and PSD increment limits. This presumption ignores the fact that, by law, developers must comply with applicable standards. Thus if permit agencies used the same unvalidated models and emissions estimates, they would not permit the capacity projected in the No Action Alternative.

Hydrology

The hydrologic system of the Piceance Creek Structural Basin is very complex. The DEIS treats this system in a highly qualitative manner despite the availability of a large amount of quantitative information that was not used, e.g., information contained in numerous U.S.G.S. publications. There are numerous contradictory qualitative comments that are not supported by the information given. There are frequent instances where the l mited amount of quantitative information given is inconsistent. Frequently the hydrology discussion would benefit from the inclusion of diagrams, tables, and maps that are less vague than those used. The hydrology discussion appears in several places rather than all in one place which probably contributes to the consistency problem.

Socioeconomics

The discussion in the DEIS with regard to socioeconomic concerns (118)
is superficial. There should be specific discussions and (130)
inventories of community needs, both collective and individual.

On page 10 of the summary a statement is made to the effect that the key to the impact predictions presented is the actual growth (baseline conditions) which will take place in the absence of additional leasing. It is recognized in the statement that conditions in the area have changed markedly since the analysis of socioeconomic impacts was made. The baseline projections used in the analysis contain key assumptions of rapid and large-scale oil shale development. As we are all aware, during the
past year many of the large projects on the Western Slope have (4)
either been delayed or indefinitely postponed. It now appears likely that development will occur at a more reduced level and spread over a longer period of time. Because the accuracy of the baseline is critical to the reasonableness of the impacts predicted, the impact assessment as currently presented must be

Mr. John Singlaub
September 21, 1982
Page Three

considered invalid. The findings, if used in the decision-making process as intended, may lead to incorrect assumptions and ultimately less than optimal decisions concerning leasing policies.

The analysis is further weakened by the fact that it is incomplete. There is no analysis or discussion, for example, of existing and projected jurisdictional infrastructure requirements and impacts (e.g., schools, water systems, law enforcement) or of the existing fiscal conditions and subsequent fiscal impacts of the proposed action. (11B) (130)

Finally, there is a noticeable absence of discussion of key assumptions and methodological procedures.

We appreciate the opportunity to comment and the efforts of the federal government to establish a viable oil shale leasing program. If you have any questions, please contact Bruce L. Petersen, API (202/457-6690) or Mary Jane Due, AMC (202/861-2860).

Sincerely,

Charles J. DiBona
President
American Petroleum Institute

J. Allen Overton, Jr.
President
American Mining Congress





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
1860 LINCOLN STREET
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OCT 7 1982

Ref: 8PM-EA

Mr. George C. Francis
State Director
Bureau of Land Management
Colorado State Office
1037 20th Street
Denver, CO 80202

Dear Mr. Francis:

We have reviewed the draft supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program and wish to offer the following comments for your consideration. First, we would like to compliment your agency for clearly and forthrightly addressing the issues discussed in this well-prepared EIS. The concerns outlined in our comments stem from the environmental effects of the actions described in the EIS.

The draft supplemental EIS contains sufficient information to analyze the key environmental consequences of the proposed action. As stated in the EIS, these consequences include:

1. Consumption of Prevention of Significant Deterioration (PSD) Class I increments at the Flat Tops if both tracts developed at the 50,000 barrels per day (BPD) level without concurrent development of other oil shale projects.

2. Violations of National Ambient Air Quality Standards (NAAQS) and consumption of PSD Class II increments near Rifle and PSD Class I increments at Flat Tops and Mt. Zirkel if development of the tracts proceeds concurrently with other proposed oil shale projects.

3. Serious adverse surface and subsurface water quality impacts due to the location of the tracts within the Yellow Creek and Piceance Creek basins due to the anticipated effects of leaching through flooded in-situ retorts or mines and aquifer mixing. The contaminants which are most likely to increase are pH, sulfates, sodium, hydrogen carbonate, and certain organic compounds. These contaminants pose environmental, public health and economic concerns.

Based on the air and water quality impacts described in the EIS, it appears that development of both of the proposed tracts (C-11 and C-18) has the potential for causing significant adverse environmental impacts. BLM should be aware of the trade-offs (as enumerated in our detailed comments) involved in a decision to lease the tracts. We would recommend that further work be done to clarify the results of the analysis done for the draft supplemental EIS.

53

2-

We believe that refinements in the air quality analysis and further consideration of groundwater conditions are needed to confirm the predictions of the EIS and identify mitigative measures that might allow development to proceed. If the studies recommended below are completed in time to be included in the final EIS, we believe the basis for a definitive decision on the proposed leases would be strengthened.

First, with respect to air quality, some of the assumptions made in evaluating the air quality impacts are incorrect. Projected development under the no action alternative should be evaluated under existing regulatory requirements. Current provisions in the Clean Air Act require that each project demonstrate compliance with applicable standards and regulations before development proceeds. Under PSD and new source review program requirements, air quality analyses are performed which ultimately determine whether or not the impacts of specific oil shale projects would exceed NAAQS and PSD increments. The air quality analysis for the EIS errs by assuming projects that could not meet air quality requirements would nonetheless proceed to development and contribute to background air quality conditions. While correction of this assumption would presumably reduce the background levels against which development of tracts C-11 and C-18 would occur, the model would have to be run again to determine whether air quality standards could be met. The accuracy of the model would also be improved if actual meteorological data were used rather than the screening technique employed in the draft EIS. (1) (79)

If air quality standards violations would still occur, your agency may wish to consider several options that could allow substantial oil shale development and still maintain clean air requirements. We suggest that the final EIS evaluate options such as, requiring more stringent BACT, obtain offsets from permitted facilities, retrofitting existing plants, or obtaining a variance under Section 165(d) of the Clean Air Act. These options are discussed in more detail in a recent EPA report entitled "Evaluation of Alternative Prevention of Significant Deterioration Policies, A Case Study of Oil Shale Development in Colorado and Utah," April 1982 (copy enclosed). (223)

As to the adverse water quality problems identified in the EIS, we agree with your conclusion that the location of the two tracts is one of the most difficult places in the Piceance Basin in terms of water impacts. The most promising mitigation measures from an economic standpoint appears to be careful site selection and planning to minimize the impact of mining activities on groundwater regimes. Although tract C-18 appears somewhat better suited for development than C-11 because of its reduced potential for impact on groundwater discharge, there is still a potential for serious water quality problems in surface and subsurface waters regardless of the shale recovery technique that is used. Other suggested mitigative measures such as grouting or filling of the mined area with insoluble material, backflooding of underground retorts or leaching of spent shale prior to disposal do not appear economically feasible.

53

Detailed Comments
prepared by
The U. S. Environmental Protection Agency
on the
Draft Supplemental EIS for the
Prototype Oil Shale Leasing Program

Air Quality:

The approach taken for evaluating the air quality impacts of the alternatives is incorrect. The document assumes that National Ambient Air Quality Standards (NAAQS) violations and Prevention of Significant Deterioration (PSD) increment consumption for both Class I and Class II increments in various locations will have already occurred due to other potential developments in the region of air quality impact.

Instead of assuming these conditions, the projected development under the no action alternative should be evaluated under the existing regulatory requirements. This requires the assumption that a project would not receive a permit and therefore would not be built if it could not meet the existing requirements. Under the leasing alternative the document should show the necessary steps for development within the allowable air quality limitations. This approach should look at constraints on the ultimate size of the lease development or on alternatives such as offsets from other facilities. (1)

One cannot at this time presume that there will be significant changes in the Prevention Significant Deterioration Regulations or in any of the ambient air quality limits except particulates. Since the particulate standard revision has not yet been proposed, a conservative approach should be taken to evaluate particulate impacts.

A technical review and analysis of the emissions inventory on page 111, shows no relationship between the emission rates estimated and the existing regulatory limitations. For projecting these emission estimates one should assume that the source is operating at 100% of capacity and emitting at the legal limit. (146)

In the Air Quality Analysis the Topographic Air Pollution Analysis System (TAPAS) models were used. These models are considered nonguideline and with the information provided, a determination can not be made on the adequacy of their use. In order for an analysis of the modeling to be done, a complete description of the model and its inputs is necessary, and should include as a minimum, the dispersion scheme, the meteorological data used, how worst case conditions were assumed, how terrain is accounted for, how plume height is determined, whether/how deposition is accounted for, and the chemical conversion rate used by NO to $NO_2$. The worst case conditions modeled were E stability with a 4 meters per second westerly wind. EPA uses F stability and 2.5 meters per second as worst case conditions for screening purposes. If these conditions were used here, the modeled concentrations would be larger than those obtained. Real meteorological data should be used instead of the screening method considering the results obtained. (59) (79)

Groundwater:

Lease sites further away from the Piceance Creek than C-11 and C-18 would be desirable because of the upward movement of groundwater from the Green River Formation through the Mahogany zone and other oil shale zones to Piceance Creek. The closer the mining operation is to the creek, the greater the potential for interfering with the creek's recharge mechanism.

C-18 is preferable to C-11 as far as groundwater impact is concerned for the following reasons:

A) C-18 is further from Piceance Creek and thus would have less impact on the groundwater recharge mechanism for the creek.

B) C-18 has fewer springs and seeps which would have to be avoided in placement of spent oil shale if leachate production is to be kept at a minimum.

C) C-18 has a fewer alluvial valleys which could be impacted.

D) C-18 has a better landscape (few steep slopes) for sedimentation ponds and ponds will be needed for mining de-watering operations.

One potential adverse impact on groundwater not evaluated in the EIS concerns the effects of subsidence. If saline minerals are recovered by steam injection, then the resultant subsidence could substantially alter the flow condition. This problem should be evaluated in the final EIS. (250)

Surface Water Quality:

1. The EIS should focus on the impacts of four prototype leases (two existing and two proposed) on the White River drainage. The cumulative impacts on Piceance Creek, Yellow Creek, and the White River need to be expanded. The discussions should include water quality parameters such as fluoride, boron and phenols which are known to have caused water quality violations when mine discharge water was released from Tract C-b. (224)

2. The EIS should also examine the performance history of the existing lease tracts U-a and U-b. The hydrological problems associated with these projects, such as reinjection performance, should be discussed and evaluated. Mitigation of surface and groundwater quality impacts should recognize the existing surface discharges at U-a and U-b and how these would relate to surface development of Tracts C-11 and C-18. (225)

3. The EIS should stress the utilization of environmental lessons learned in the development of Tracts U-a and U-b in planning for future prototype leasing. Future mitigation plans should be based on a realistic evaluation of the performance of existing operations. (226)





In summary, the expected air quality standards violations and water quality impacts of leasing and development of tracts C-11 and C-18 require us to rate this EIS EU-1. (The proposed full development of both tracts would be unsatisfactory from the standpoint of public health and welfare and environmental quality.) If the decision is made to lease both tracts, we would recommend that further studies be undertaken and/or mitigative measures proposed which would ensure compliance with environmental standards. If only one of the tracts is offered for development and further analyses indicate air quality standards can be maintained and water quality impacts can be mitigated we would rate the single-lease option in the category of Environmental Reservations (ER-1). Because of the smaller number of springs and alluvial valley areas and the better reclamation potential of tract C-18, we consider it to be the environmentally preferred alternative among the two tracts considered in the EIS.

We appreciate the opportunity to review this well prepared EIS. Attached are additional detailed comments on the air and water quality aspects of this proposed action. Please contact Gary Voerman of my staff at (303) 837-4831 if we can be of further assistance in this matter.

Sincerely yours,

Steven J. Durham
Regional Administrator

Enclosures

54

United States Department of the Interior

BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

OFFICE OF THE DIRECTOR

January 3, 1983

Memorandum

To: Deputy Director, Energy and Mineral Resources
Bureau of Land Management

Through: Assistant Secretary—Energy and Minerals

From: Director, Bureau of Mines

Subject: Bureau's Oil Shale Research Facility at Horse Draw

In reference to a memorandum (attached) to the Bureau's Oil Shale Coordinator from the Bureau of Land Management (BLM) District Manager at Craig, Colorado, clarification was requested on three questions. Our response is as follows.

1. The Bureau of Mines, through the Memorandum of Agreement with BLM and Multi Mineral Corporation (MMC), accomplished many of the intended goals of the Horse Draw Facility, and no future research is planned at this time.

2. It is correct that the Bureau of Mines would allow a lessee of the Prototype Oil Shale tract to utilize any or all of the facilities as part of the lessee's development activities and that the Bureau of Mines would be responsible for some reclamation at the site. However, you should be advised that MMC requested permission to sell some of the equipment at the site which was granted. We also advised MMC that the shaft opening must be securely sealed to meet statutory provisions. This was discussed with Mine Safety and Health Administration and it was agreed that a heavy steel plate anchored to the shaft collar and equipped with a vent pipe at least 15 feet high with an elbow and a screen on the end should meet the requirements. The existing fence around the shaft will provide additional security.

3. Inclusion of the Horse Draw Facilities in the Prototype Oil Shale tract, if leased, will not cause any programmatic conflicts within the Bureau of Mines and we would fully support the decision of BLM to include the site as a potential lease tract.

Robert C. Horton
Director

Attachment

bcc: Secretary's File
Secretary's Reading File (2)
AS/EM (2)
Director's Reading File (2)
Files AD/MR
AB/MR
Tom Loomis, DOI
Chief, C&D
R. Seibel

EBM:RSeibel:mmr:1-5-83:634-1246

55

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR, FISH AND WILDLIFE SERVICE

JAN 10 1983

Memorandum

To: Director, Office of Environmental Project Review

From: Associate Director, Fish and Wildlife Service

Subject: Prototype Oil Shale Leasing EIS, Bureau of Land Management, July 1982

This will confirm the January 6, 1983, telephone conversation on the subject EIS between Tom Loomis, OEPR, and Sumner A. Dole, Jr., Staff Biologist, Coal, Division of Ecological Services, Fish and Wildlife Service (FWS). The FWS Region 6 (Denver) office worked directly with BLM at the field level in the preparation of the EIS. Our Ecological Services staff in the region is satisfied with the EIS and has no further comments.

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

PUBLIC MEETING ON THE

DRAFT SUPPLEMENTAL

ENVIRONMENTAL IMPACT STATEMENT

FOR THE

PROTOTYPE OIL SHALE LEASING PROGRAM

Stetson Room
Ramada Inn Foothills
6th Avenue and Simms
Lakewood, Colorado

Tuesday,
August 24, 1982





I N D E X

UNIDENTIFIED SPEAKER: We'll waive.

MR. SMITH: Okay: Tom waived. D. W. Lewis. Mr. Lewis?

(Pause.)

MR. SMITH: Well, he was representing Mobil Oil. How about C. S. Howser with Mobil Oil?

UNIDENTIFIED SPEAKER: We'll waive it.

MR. SMITH: You'll waive? Okay. Lillian Valenzuela? If you would come up here, please?

UNIDENTIFIED SPEAKER: Who do you represent?

MS. VALENZUELA: I'm with -- well, I've followed this for a while. I'm with CU and I'm in environmental conservation.

I have noticed that people tend to talk a lot about -- would be willing to explain things that they know a lot about, but tend to, regarding the unknown, tell us not to worry and I just want to point out some of the unknowns that I've noticed in previous environmental studies, particularly in that Basin, that haven't been addressed quite as deeply as they should have been.

The groundwater studies, it looks like they are being dealt with more thoroughly in this draft.

I think there's a problem with funding. I know that the Soil Conservation Service in the Piceance Creek Basin has been trying to get extensive studies done and the kind of specific information that they need. They need a great deal of





more support from the State and from courts -- studies that are particularly directed at environmental information. Right now they pretty much have to follow the companies who have already drilled wells around and get the information.

The other issue is subsidence. That's dealt with in areas where other mining is to be done, dealt with on the long term. I think also issues that might be considered are the amounts of groundwater disturbance and subsidence that is going to result in groundwater -- the dewatering process in the mine, 111 and this can cause structural instability at reservoir sites, cause grade-slope disturbance and the additional weight of all the shale piles, the disposal piles is a factor that needs to be considered.

The problem with heat or the heat polution problems I don't see dealt with generally from a -- well, Colony was going 112 to cool something like 2700 to 3,000 tons of shale, heated shale at 900 degrees for an hour -- hours -- and it's rather staggering to see that much coming through and being disposed of and having other drains to which streams are passing through, and to have the deal with the heat polution that would occur in the streams, the damage to wildlife, fish.

The other issue I don't see dealt with at all is the effects of the hydro-fracturing techniques that have been 110 conducted in the Basin, their effects on groundwater and the mixing of the aquifers, particularly the 1973 Rio Blanco Nuclear

Project which was held particularly in the site of the new lease site C-11, which is 2 South 97 West.

The reason they did the gas-stimulation project in 1973 was to release a huge store of gas at that very site. Ben Wiseman did a study back then that showed that there might have been structural damage in the area of his lease tract, the Multi Mineral site, and I don't see much follow-up on that. That could have implications for mining safety and groundwater and that gas was to be released under extremely high heat, high temperatures, it was vaporized. There was some problems with the core hole that was drilled that was damaged that could have connected with the aquifers and whatever radiological effects may have been present, but also structural damage to the aquifers and to the rock structure.

The damage at present, the USGS -- that has been done by the present site has not been thoroughly reviewed, I think. The USGS records show that there has been a steady increase in sedimentation deposits since 1977, 1977 through 1980, an extreme rise in sedimentation load in the streams. And some of this is expected. There was a rise of some 270,000 tons per day on September 7th of 1977. This is an interesting figure.

So I think the present damage should be thoroughly evaluated for the sites that are now operating, even though they are not at a commercial stage. Thank you.

MR. SMITH: Thank you. Hester McNulty?





MS. McNULTY: I am Hester McNulty speaking for the League of Women Voters of Colorado. Some of our 23 local Leagues are in the region which would be affected by additional prototype leases and they will address their specific local concerns at the Grand Junction meeting.

First, the League compliments you for the preparation of a good Environmental Impact Statement. It's readable, concise, delineates the major issues and analyzes alternatives. We also think, in most cases, the probable impacts are assessed correctly, within the limits of existing data.

We have found, however, that there is more recent information on the quality of raw shale lechates than was used in the preparation of the EIS. Laboratory studies have indicated that particular emphasis should be placed on aluminum, boron, fluoride and zinc, as well as molybdenum in Mahnogany mined shales. This study also recommended that sulfur species in lechate should be determined. I believe some of that work has been done, has been carried on at CSU. We believe the EIS should more adequately address the runoff and lechate from raw shale piles. 113

The League's preference is for the No Action Alternative. We have chosen this alternative because the EIS indicates that even without additional prototype leases, the region could be subject to serious air quality problems and in some cases violate health standards. Moreover, air quality in wilderness and

recreation areas would be threatened. Leasing should be post-poned until technology either eliminates or substantially reduces emissions from oil shale projects.

However, if the decision is made to lease, it should be consistent with the original goals of the Prototype Oil Shale Leasing Program which were to test the technical, economic and environmental feasibility of differing oil shale technologies. 16 Production should be limited to 10,000 barrels per day until the technology is proven, the economic feasibility is established and the environmental data is analyzed. Because both tracts would demonstrate the same multi-mineral technology, leasing should be limited to one tract.

After eight years of the prototype program, no technologies have yet been tested. This fact and recent events on private lands should indicate that for the prototype program to fulfill its original purpose, a 100,000 barrel per day limit is desirable. New technology for emissions control could be also developed so that if a larger operation proved to be feasible, the impact on air quality would be reduced or eliminated.

If the decision is made to lease, Tract C-18 was judged to have less severe impacts than Tract C-11 and is therefore preferable. And, if a lease is granted, the environ-mental stipulation should clarify that state environmental regulations and standards, which are more stringent than either





federal regulations or law, will be complied with. We believe this is necessary because EPA is in the process of issuing weak 78 regulations for environmental programs and there is a possibility that new federal legislation will not protect Colorado's resources. The question of primacy could arise.

We also think the state should be a party to those decisions in the environmental stipulations which are left to the discretion of the mining supervisor. Examples are additional air, surface water and groundwater monitoring requirements, the 114 use of pesticides, and clean-up of hazardous or oil spills.

Finally, if the lease is to prove the feasibility of multi-mineral processing, then the leasing must require -- the lease must require the processing and economic recovery of 27 nahcolite and dawsonite. This stipulation must be added or any reason for the lease will be invalidated. Thank you.

MR. SINGLAUB: Thank you.

MR. SMITH: Anne Vickery?

MS. VICKERY: My name is Anne Vickery. I'm speaking today for the Colorado Mountain Club and for the Wilderness Society. The Colorado Mountain Club is a state-wide recreation and conservation organization with over 7,300 members. The Club takes backpacking, hiking, climbing, camping and skiing trips, open to the public, into the Colorado high country, including the wilderness areas. The Wilderness Society is a nation-wide non-profit organization of 60,000 members dedicated to the

preservation of wilderness and other public lands.

BLM is to be complimented for a straight-forward draft EIS that clearly describes impacts. This type of document makes the public comment process much easier to participate in.

Members of the Mountain Club and the Wilderness Society have been alarmed to read in the Draft that even with the "No Action Alternative" there will be a violation of the $SO_2$ standards in the Mt. Zirkel Wilderness. Given this situation, we are even more concerned that if both proposed tracts, C-11 and C-18, are leased, there will also be a violation of the $SO_2$ standards in the Flattops Wilderness. This creates an inconsistency which must be resolved. The lessees are required to conduct operations in conformance with all applicable federal, state and local laws. This is impossible if the federal standards PSD increments will be violated. 1

Both the Mountain Club and the Wilderness Society will be turning in written comments, but I'd like to make a few points where the Final should more clearly address the air quality issues.

One, the baseline for the No Action Alternative should be clearly spelled out. The Hayden Power Plant and the Utah Oil Shale operations should be included. 2 14

It is also very important that the air pollution from secondary, tertiary and associated sources, however these are defined, be included in the baseline and in each alternative.





The paragraph on page 18 says too little is known about these sources to analyze them. However, these sources may be the ones causing the most problems and these sources are as much a part of oil shale as the retorts. The prototype program should be analyzing impacts from all related sources. The bottom line is what is the air quality like over the high country and the wilderness areas, not which operations are listed on paper. All emissions have to be modeled; otherwise we are just playing games. 2

Number three, lessees must be required to monitor visibility and acid deposition inside the wilderness areas, first to obtain baseline data, and second, to record any changes associated with new leases. 20

In the scoping comments, on the EIS, the Mountain Club requested that regarding Mt. Zirkel, Flattops and the Maroon Bells-Snowmass Wilderness areas, there be a specific analysis of the following: visibility degradation, concentration of fine particles, and acid deposition impacts on lichen, brook trout, aspen and the pH of selected lakes. To the best of my knowledge this specific information is not in the Draft, although it is referred to beginning in the discussion on page 109. These are difficult questions, but they are the questions to which we want answers. 9

In their scoping comments, the Mountain Club also requested that preference in the leasing procedure be given to

operators demonstrating zero-emission technology and demonstrating less labor-intensive technology. This relates to the second goal of the Prototype Program which is to develop a full range of environmental safeguards. These suggestions were not 19 addressed. The impression is given that in the Prototype Program, designed, among other things, to develop environmental safeguards, BLM is looking only at the materials to be mined and not at technology which truly produces environmental safeguards. We ask that the Final correct this impression.

Impacts on wilderness areas are address with respect to increments in the air quality section. The consequences of these impacts need to be addressed throughout the document and in the sections on wildlife, vegetation and recreation. Brook trout, aspen and lichens are considered as indicator species of impacts on wildlife and vegetation. Visibility is a recreational 9 resource. For example, page 155 discusses visual impacts, but only in and around the tracts. There is no mention of wilderness areas; neither is there mention of the severe particulate problem, and therefore visibility problems, over a wide area in western Colorado. This problem is documented on page 54 and discussed on page 121, but not included in the later discussions.

Seven, In considering air quality, wildlife, vegetation and recreational impacts, BLM must not only look at the wilderness areas. Most of the White River National Forest and the 227 Routt National Forest lie between the Piceance Basin and the



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respective wilderness areas. There are grazing allotments, timber, trout streams and scenic areas in these forests that will be impacted.

Now I'd like to show you several slides of the Flattops and the Zirkel Wilderness Areas so we can get a better understanding of the areas we're talking about.

(Slide.)

I don't know if everybody can see this. This is a view of one of the many lakes in the Flattops Wilderness Area. Flattops is known for its fishing. Flattops is the second largest wilderness area in Colorado -- 235,000 acres.

(Slide.)

Flattops is situated so the visitor has incredible views of other wilderness areas. This is looking northeast from Flattops to the Zirkel Wilderness, some 80 to 90 miles away.

(Slide.)

This is looking east from the same point to the Gore Range, some 60 to 70 miles away.

(Slide.)

This is looking southeast some 70 miles to the Holy Cross Wilderness and in the center to the Maroon Bells-Snowmass Wilderness. Any type of visibility degradation or regional haze would affect these magnificent views.

(Slide.)

Here is a scene inside the Zirkel Wilderness near the

Wyoming border. The Zirkel is an area of 139,000 acres.

(Slide.)

Here is a view from Davis Peak in the Zirkel, looking toward the Sawtooth Range.

(Slide.)

This is a final view of one of the many lakes in the Zirkel. The Zirkel is also famous for its fishing. Any change of the pH in the lakes that would affect the quality of life, or in the streams in both of these wilderness areas would be a real disaster.

In conclusion, the Mountain Club is made up of people who love the mountains, who spend a lot of time near and above timberline, who put the registers for hikers to sign on top of the high peaks. We reflect the sentiments and concerns of all those who enjoy the Colorado Rockies in this manner. The Wilderness Society is composed of people throughout the nation who have worked hard to designate wilderness and to protect designated areas. To all of us, any kind of visibility degradation, regional haze or acid deposition in these areas is unacceptable.

Thank you for this opportunity to testify.

MR. SMITH: Thank you. Pauline Plaza?

MS. PLAZA: My name is Pauline Plaza and I work with the National Audubon Society. I have a few very brief comments for the hearing, to be supplemented by written comments later.





It's very obvious from the EIS, which by the way, I would join with Hester and with Anne in congratulating you for, it's very obvious from the EIS that even the No Action Alternative will have critical environmental and socio-economic impacts; that if any additional leasing occurs these would increase. For this reason, and for another one which I'll delineate in just a minute, we do not see any reason for additional leasing at this time.

If the decision is to lease, it should be only one tract, probably C-18, due to the lower impacts on soils and the better reclamation prospects at that site, lower impacts on the wildlife and several other items.

It's been very apparent from the last -- the events of the last six months that oil shale is not going to be the thing that gets the United States out its dependence on imported oil. The oil companies will not develop oil shale as long as there are alternatives available and there are alternatives available right now -- the price of oil is down, there's a glut on the market -- so the idea of developing oil shale as a substitute for this imported oil is not, I think, a very valid one and I think the past six months has demonstrated this very clearly.

Therefore, I suggest that there is no rush to lease these tracts, that it should not be done at this time.

MR. SMITH: Thank you. That was all that I had down for -- when they came in and signed in for formal statements.

Are there any others present at this time that would like to come forward and make a formal statement?

Yes; would you please come forward? Please state your name and who you represent.

MR. YONKEY: My name is Bob Yonkey. I'm regional counsel with the Environmental Defense Fund, the Boulder office.

We have a relatively large number of technical comments on the EIS which we will be filing in written form by the comment deadline, but there are a number of issues that I wanted to highlight with our oral comments here today.

First, with respect to the treatment of alternatives, we think that as a general matter, the EIS and historically I think most of the EIS's in this area have been deficient in not addressing alternatives beyond the narrow scope of the responsibilities of the immediate management agency. In this case, the EIS was prepared by the BLM and it reflects the BLM's very narrow focus and does not look at the broader responsibilities of the Secretary of Interior and does not look at broader alter- 8
natives which we think should include, at a minimum, addressing other fuel alternatives and conservation alternatives.

In terms of other fuel alternatives, we think that there should be a general discussion of a comparison between the need for developing oil shale as a fuel resource as compared with the likely development of fuel resources from expanding oil and gas drilling that is now occurring under the -- partly under the







BLM's auspices in the Overthrust Belt, and also other synfuels options.

In addition, there should be some emphasis given to what will happen to the demand for, particularly, liquid fuels as various conservation scenarios come into play, including particularly the automobile fuel requirements which will substantially reduce demand for liquid fuels during the next decade.

The failure to address these broader alternatives, I think, is a major deficiency and inconsistent with the requirements of NEPA.

In addition, there is a narrower set of alternatives that should be addressed which are not. One of the consequences of the Tenth Circuit's decision in <u>EDF v. Andrus</u> in which the Court of Appeals held that it was not necessary for either the Bureau or the Geological Survey to prepare an EIS associated with its review and approval of a detailed development plan, thrusts upon the Bureau and the Survey the responsibility to address certain alternatives at this stage, at the leasing stage, which the Court said need not be addressed at the plan approval stage.

I think those alternatives should include much more detailed discussion on siting options, particularly with respect to the air quality impacts of various site locations. One of the things that is clear from the evaluation of the data, particularly the meteorological data, is that the air quality

impacts will significantly be a function of the altitude at which the major emitting points are located. If they are located in valley terrain where trapping features of the local meteorological conditions will cause pollutants to be concentrated, then the local effects of that siting decision would be very much different than if the sites are located on higher terrain where the emissions will be exposed to regional transport winds. 125 139 Conversely, locations at higher elevations will have much more significant impact on the higher terrain Class I areas.

And these tradeoffs are the kinds of tradeoffs that NEPA intended be evaluated before the Government made a decision which would significantly affect human environment. The failure to address those kinds of tradeoffs in this study, and given particularly the Tenth Circuit's decision that you need not address them later, imposes a duty to address them now.

Another alternative that would fit into that catagory would be to address some of the control technology options which are not clearly set forth in the analysis.

The amount of emissions from the facilities that are likely to be sited would clearly be a function of the types of 138 control technology and to the extent that there are options in terms of the amount of pollution likely to result as a result of the choice of control technology, those choices should be evaluated.

Now, with respect to some of the specific air quality



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impacts, we are generally pleased with the approach taken for the analysis of $NO_2$ and $SO_2$, but we have some specific problems with some of the other pollutants that were addressed in the EIS. Before I pass $SO_2$ behind, I would like to note particularly that you have neglected to treat the State Catagory I areas as having legally enforceable limitations on $SO_2$, which are the equivalent of a Federal Class I area, and there is an Attorney General's opinion in Colorado in which the Attorney General said that those provisions of the State statute establishing those Catagory I increments are enforceable. They would apply particularly to Dinosaur National Monument and Colorado National Monument, and the failure to address the effects on those two national monuments, given the limitations for $SO_2$ in the State law, is a serious deficiency in the model. 143

One of the things the model assumed was certain worst-case conditions based upon wind patterns that would blow in the direction of the Flattops. Those worst-case analyses, of course, do not address what the impacts will be when wind conditions are in the direction of Dinosaur National Monument. Therefore, it's impossible from the modeling that's performed for this EIS to even begin to guesstimate what the impacts will be on the Catagory I areas.

With respect to acid deposition, which is a point that Anne made in her comments, we feel there are some serious deficiencies in the modeling. You have made certain assumptions

regarding dry deposition, but there has really been no significant effort to evaluate wet deposition. The data that has been obtained from scientific investigations of the acid deposition process in the East tends to indicate that between 70 and 80 percent of the sulfate acidity is formed and deposited through the wet process. Assuming that that percentage prevails also in the West, you have ignored what is probably the much more 7
significant process for acid deposition.

In that context we are, of course, generally interested on the extent to which the relatively high volumes of $SO_2$ and NOX will increase the existing rates of acid deposition in the West and you have made some estimate in the EIS to summarize the existing deposition data. But there has really been no effort to attempt to characterize the vulnerability of the terrain and what the effects of the additional amount of acid deposition that would result from oil shale emissions would likely be.

Given the requirement of the Clean Air Act that the Federal land manager may waive Class I increments in the event that he determines that air quality related values will not be adversely affected, and since the Forest Service -- Rocky Mountain Region of the Forest Service has identified acid deposition as one of the effects of air quality emissions which could well have an impact on air quality related values, we think that that requirement of the Clean Air Act imposes upon you a duty to make a more careful analysis of what the likely consequences would be







of the increased acid deposition from these sources, particularly with respect to the Class I areas which, of course, Congress has 7
set aside to be preserved for all Americans and has also established a special procedure under the Clean Air Act.

So, the type of modeling that is required to estimate wet acid deposition, of course, is in its developmental stages. There wouldn't be such a thing as an EPA-approved model for that determination, but there have been some models developed for use in the East. So we would suggest that you investigate which of those models that have been developed in the East would be appropriate for use in this setting.

But some effort must be made to use the best scientifically-available procedures for attempting that analysis.

We also have concerns with respect to carbon monoxide and I guess we'll leave those for our other written comments.

In closing, with respect to ozone, I think you have indicated that the EIS relies upon the Uinta Basin EIS analysis for ozone which, of course, was released only last Friday, which has not shown up in my mailbox yet, and is not subject to any review on our part and therefore it's impossible for us to present any kind of comments here today on your ozone analysis and it may well be appropriate for you to offer an additional opportunity either for public hearing or at least a comment period on the ozone factor that extends from the date the ozone analysis became available.

MR. SMITH: Thank you, Bob. Are there any others who would like to make a formal statement at this time? Kevin?

MR. MARKEY: Kevin Markey, Friends of the Earth.

I have a few comments and a few questions that I'd like to raise at this point preliminarily. We will present a more formal presentation at the Grand Junction hearing.

Three questions: Number one, are either of these tracts, C-11 or C-18, involved in discussions which are reportedly occurring between the Bureau of Land Management and the Synthetic Fuels Corporation?

Secondly, we would like to know a little bit more about the status of the sodium lease tract conflict, and whether in fact there has been any agreement or any stipulation signed by the owners of the sodium lease tract.

And thirdly, we think it's important and if it can be done today it would be helpful, if not sometime very soon, to clarify what, in fact, are the air quality assumptions in the baseline as to which projects are actually being counted in the emissions and the ambient air impacts. 2

Second of all, over the past several years, as BLM and others have discussed the possibility of testing multi-mineral technology, many environmentalists and other citizens have sought a test of multi-mineral oil shale processing because it might offer some environmental advantages such as reduced waste disposal, reduced salt leaching, and the air pollution



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clean-up potential of nahcolite, one by-product of multi-mineral processing.

However, the Department of Interior's proposed lease will not even require the processing of associated minerals as it does not require the maximum economic recovery of nahcolite or dawsonite. In our scoping comments and in several other junctures we have mentioned the need for some sort of requirement to insure that this does, in fact, become a test of multi-mineral technology, in contrast to the view that we would require any specific technology. That's not the case. What we would require or what we would like to see BLM require is, in fact, maximum economic recovery of nahcolite and dawsonite. 27

Thirdly, you might think that after hearing the compliments that have been paid to your EIS today by some members of the environmental community, that only an EIS which describes horror stories is going to get any compliments. That's not exactly so. It is a good EIS, though, mainly because it is fairly well written and it does make quite clear what the assumptions and what the effects of the proposed actions are. There are some problems, however; we never give unqualified endorsements of anything.

First of all, it would be helpful to clarify the air quality assumptions and it would also be helpful to have a list at some point similar to the list which appears in the air quality document, of the precise plants and what their production 14

ranges would be at various times during your scenarios.

Second of all, it's absolutely crucial to assess the health and safety impacts, especially for mine-assisted in-situ. The Bureau of Mines, in their test at the Horse Draw facility, has many times -- has considerable amounts of data in terms of 134 the amount of methane which is present at the lower levels, at the lower horizons, and that needs to be assessed as well as the general problems with mine-assisted in-situ.

The National Research Council's Committee on Synthetic Fuels Facility Safety, which I served on, did an analysis of the various problems associated with oil shale and other synthetic fuels technologies, and the one technology which received the lowest grades was in fact mine-assisted in-situ and it's important to look at that.

As has already been mentioned, there's an inadequate 8 analysis concerning energy alternatives. We'll discuss that further in Grand Junction. And there are several larger land-use considerations. It's not clear that, in fact, C-11 and C-18, 125 C-11 or C-18, are the best tracts to achieve the goals and objectives of this particular leasing action.

If there is any leasing, we would prefer C-18, and only C-18, and I think the problems which you have in terms of resolving the sodium lease conflict indicates the error of issuing more sodium leases up there in the Piceance Basin and a need to reassess that entire action there.



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Finally, there have been problems. The Prototype Program, if one were to look at it, at least at the symptoms of what has happened over the last eight years, one would make the assumption that the Prototype Program is a failure. It's a 19 failure because BLM failed to assess the maturity and readiness of the technologies that in fact it desired to test back in 1973-1974.

Those technologies could perhaps be classified as obsolete even then when they were offered at that time. Today we are quite a ways -- we have progressed quite a ways in terms of research and development and still the industry is not ready to proceed. BLM could be making another mistake which will lead to the no diligent development, greater uncertainties, with respect to speculative land holdings and uncertainties as to whether development will occur at all, the possibility of new Colony projects which will fail in mid-stream, and increase the uncertainty of planning and in dealing with the impacts in the communities in northwest Colorado.

So it's important to address the maturity and readiness of the technologies which are the objective of this leasing action as part of the EIS for there to be some type of stipu- 19 lation which in fact requires any bidders on those leases to demonstrate the maturity and readiness of the technologies.

We perhaps can return to those questions if there's nobody else.

MR. SMITH: Thank you. What we'll do on the questions, Kevin, we'll go ahead and see if there's any other formal statements. If so, we'll take those and then we'll get right into the questions.

Are there any other formal statements at this time? Yes?

MR. MULLEN: My name is Norm Mullen and I'm with the Colorado Open Space Council and I'm also speaking today for the Colorado Wilderness Network.

The Colorado Open Space Council is Colorado's statewide conservation coalition of 48 member organizations which have a cumulative membership of 30,000 to 40,000 people and also there are about 1100 individual members of the Colorado Open Space Council.

We've already heard a lot today about the effects on the wilderness areas of Mt. Zirkel and Flattops, so we are very concerned about those.

We're also concerned about the effects on Rifle. The Colorado Open Space Council helped to start the Clean Air Coalition and when we see 24-hour standards exceeding the annual average by 41 times in Rifle, we're concerned about that also.

It seems as if the Impact Statement should discuss the air quality related values and the impacts of these projects and the No Action Alternative on air quality related values more 9
than it does and go into more detail about how the exceeding the





increments will affect those values.

That's all. Thank you.

MR. SMITH: Are there any others?

(No response.)

MR. SMITH: If not, I guess we'll go into a few minutes of questions and answers.

Kevin, on your's, there's some other BLM'ers in the audience. As far as I know, there are no discussions between the Synfuels and C-11 and C-18. Now, if there's any other BLM'ers that know otherwise --

MR. SINGLAUB: We're just from Meeker.

MR. SMITH: They're shaking their heads "no".

MR. MARKEY: Could I ask another clarifying question on that? Whether there are any discussions taking place with Synthetic Fuels Corporation on other tracts which might, in fact, have an effect on the cumulative analysis which is being done for this EIS?

MR. SMITH: Apparently no, Kevin, there is not.

Your second one on the progress we're making with the Wolf Ridge lease. There's been a substantial amount of negotiation. Again, as far as I'm aware, there is no final agreement reached; is that right, Bob?

MR. LEOPOLD: Kevin, we anticipate September 4th that we will have a draft cooperative agreement from Wolf Ridge to the BLM. At that time we will sit down internally and also with

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DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM

BUREAU OF LAND MANAGEMENT PARTICIPANTS:
CURT SMITH, AREA MANAGER
JOHN SINCLAIR, OIL SHALE PROJECT TEAM LEADER

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TRANSCRIPT OF PROCEEDINGS AT THE PUBLIC MEETING, HELD AT THE FAIRFIELD CENTER, MEEKER, COLORADO, ON WEDNESDAY, AUGUST 25, 1982, COMMENCING AT APPROXIMATELY 7:00 P.M., BEFORE ME, KAREN WITEK, CERTIFIED SHORTHAND REPORTER IN AND FOR THE STATE OF COLORADO.





THAT WHEN THE LEASE SALE, OR IF THE LEASE SALE OCCURS, THE CONDITIONS OF WHO GETS WHAT ON THAT SODIUM LEASE ARE KNOWN. IF WE HAVE MORE QUESTIONS ABOUT THAT, I CAN GO INTO MORE DETAIL ON THAT AGREEMENT, IF YOU LIKE.

SO BASICALLY THAT'S WHAT WE FOUND OUT.

CURT SMITH: THANKS, JOHN. NOW WE WILL START THE PUBLIC COMMENTS. WE HAVE FIVE PEOPLE THAT HAVE SIGNED UP TO MAKE FORMAL PRESENTATIONS AT THIS TIME. I WOULD LIKE, WHEN I CALL THAT INDIVIDUAL, FOR YOU TO PLEASE COME FORWARD, STATE YOUR NAME AND WHO YOU REPRESENT, AND STAND ON THE COURT REPORTER'S RIGHT HERE, IF YOU WOULD.

ALSO AGAIN, I REMIND YOU, I AM GOING TO LIMIT YOU TO EIGHT MINUTES PER PRESENTATION. WHEN 30 SECONDS ARE LEFT, I WILL LET YOU KNOW AT THAT TIME.

FIRST PERSON SIGNED UP IS NICK THEOS.

NICK THEOS: MY NAME IS NICK THEOS. I'M A RANCHER IN MEEKER, COLORADO, RIO BLANCO COUNTY. I OPERATE ON THE PUBLIC LANDS DOWN ON THIS PICEANCE CREEK AREA.

I READ PART OF, WENT OVER PART OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT. IT'S WELL PREPARED. I GIVE YOU PEOPLE CREDIT FOR AT LEAST COMING OUT WITH ONE GOOD STATEMENT THAT I READ, DRAFT STATEMENT. IT'S A LOT BETTER THAN THE GRAZING STATEMENTS THAT'S BEEN PUT

OUT BY YOU.

THE ONLY COMMENTS I WOULD HAVE IS, AS A RANCHER -- AND I'M SPEAKING FOR THE COLORADO CATTLEMEN AND THE COLORADO WOOLGROWERS HERE TODAY -- IS THAT WE ARE NOT CONCERNED WITH THE LITTLE AREA THAT THESE LEASES WILL TAKE UP. WE KNOW THAT WE CAN GET ALONG WITH THE OIL COMPANIES. WE KNOW WE CAN GET ALONG WITH THE ROADS THEY WILL BUILD, AS LONG AS WE CAN USE THEM TOO TO MANAGE OUR LIVESTOCK.

ONE CONCERN OF OURS IS THE PEOPLE THAT WILL BE OUT THERE. IT'S GOING TO AFFECT OUR GRAZING, OUR MANAGING OF OUR LIVESTOCK. WE WOULD BE REAL CONCERNED ABOUT OFF-ROAD VEHICLE TRAVEL. I THINK IF WE CAN KEEP (2)

THE WORKERS, THE PEOPLE THAT ARE MOVING INTO THESE AREAS -- I THINK, JOHN, YOU SAID THAT THERE WOULD BE A 20 PERCENT INCREASE IN RIFLE AND SEVEN PERCENT INCREASE A YEAR IN MEEKER, AND THIS IS A LOT OF PEOPLE.

THESE PEOPLE KNOW THAT THOSE LANDS ARE THERE AND THEY ARE GOING TO BE TRAVELING ALL OVER. THIS IS OUR BIG CONCERN, TO KEEP THESE PEOPLE ON THE MAIN TRAVELED ROADS. SET UP AREAS FOR THEM TO CAMP ON AND STUFF, SO THEY WON'T BE RUNNING AROUND AT RANDOM, IN THE WINTERTIME SNOWMOBILING ALL THROUGH AND CHASING OUR LIVESTOCK AND THE WILDLIFE, TOO. I THINK THE DEPARTMENT OF WILDLIFE [illegible], DIVISION OF WILDLIFE





SHOULD BE REAL CONCERNED [illegible], TO [illegible]

[illegible]ENTS I WOULD HAVE. THANK YOU.

CURT SMITH: THANK YOU, MICK. CONNIE ALBRECHT?

CONNIE ALBRECHT: I AM CONNIE ALBRECHT. I AM WITH FRIENDS OF THE EARTH. I AM THE COLORADO WEST REPRESENTATIVE FROM GRAND JUNCTION, AND I AM SPEAKING IN THAT CAPACITY THIS EVENING.

RATHER THAN ZERO IN ON SPECIFIC STATEMENTS IN THE E.I.S., I WOULD LIKE TO TALK ABOUT A FEW OF THE GENERAL SHORTCOMINGS WE HAVE FOUND. WE WILL BE SUBMITTING MORE DETAILED WRITTEN COMMENTS LATER.

FIRST OFF, I WOULD LIKE TO SHARE JUST A GENERAL REACTION I HAVE GOTTEN FROM PEOPLE WHEN I HAVE TRIED TO EXPLAIN TO THEM WHY THE FEDERAL GOVERNMENT IS PLANNING TO LEASE MORE SHALE LANDS IN THE MIDST OF A RECESSION AND AN INDUSTRY BUST. I HAVEN'T BEEN DOING THIS ONLY WITH ENVIRONMENTALISTS. I HAVE BEEN ORGANIZING, TALKING TO THE GENERAL PUBLIC, TO COUNTY OFFICIALS, TO MEDIA PEOPLE. THE FIRST REACTION IN MOST CASES IS SIMPLE DISBELIEF. THE SECOND REACTION, AND I THINK THE LEADERSHIP OF THE DEPARTMENT OF INTERIOR WOULD DO WELL TO TAKE THIS INTO CONSIDERATION -- THE SECOND REACTION IS A QUESTION OF, WHY DO WE NEED TO LEASE MORE PUBLIC OIL SHALE LAND AT THIS TIME WHEN

THERE'S LITTLE DEVELOPMENT OCCURRING, OR LITTLE INTEREST BY THE COMPANIES IN DEVELOPING OIL SHALE? WHY ARE WE TRYING TO LEASE OUT A PUBLIC RESOURCE? (16)

I HAVE TRIED TO EXPLAIN TO THEM THAT THE STATES REALLY DON'T WANT THIS PROTOTYPE OIL SHALE PROGRAM AT THIS TIME. THE COMPANIES AREN'T VERY INTERESTED IN IT. THE COUNTIES HAVE SOME CONCERNS. THE ENVIRONMENTALISTS THINK IT'S CRAZY, AND THE LOCAL BLM KNOWS BETTER. BUT YOU HAVE A TEAM LIKE WE HAVE AT THE TOP OF THE DEPARTMENT OF INTERIOR, AND THEY ARE BASICALLY PUSHING FOR AS MUCH PUBLIC LAND TO BE LEASED BEFORE THE 1984 ELECTIONS AS THEY CAN. THAT DOESN'T GIVE US A LOT OF ROOM FOR ENVIRONMENTAL CONCERNS.

I APPRECIATE THE MEEKER OFFICE PUTTING TOGETHER SUCH A FAST DRAFT E.I.S. I WOULD LIKE TO SUGGEST A FEW CHANGES AND ADDITIONS FOR THE FINAL ONE.

THE AIR QUALITY INFORMATION IN THE E.I.S. WAS VERY STARTLING. ALTHOUGH IT CONFIRMED WHAT ENVIRONMENTAL GROUPS SUSPECTED WAS THE CUMULATIVE IMPACT OF VARIOUS SHALE PROJECTS, WHAT WAS REALLY GOING TO PIN US TO THE WALL, AND THE NO ACTION ALTERNATIVE REALLY SHOWED THAT. HOWEVER, IT WASN'T CLEAR IN MUCH OF THE BODY OF THE REPORT WHAT EXACTLY THE BASELINE ASSUMPTIONS WERE. THEY NEED TO BE MORE CLEARLY DOCUMENTED. I SUSPECT THIS WILL BE DONE. (2)





SECONDLY, I AM GLAD TO SEE THE SENSITIVITIES IN THE E.I.S. TO THE CLASS ONE AREAS, BUT I WOULD LIKE TO SEE MORE DISCUSSION ON CLASS TWO AREAS EAST OF THE PICEANCE BASIN AND GRAND JUNCTION. I COULD NOT FIND ANY EVIDENCE OF POLLUTION FROM OTHER SOURCES, AND I AM SPEAKING MAINLY OF AUTOMOBILE USE FROM THE INCREASED POPULATION WITH THE SHALE DEVELOPMENT. ALSO NO EVIDENCE AS TO WHETHER FACILITIES SUCH AS UPGRADING OR REFINERY EXPANSION WERE INCLUDED. I WOULD STRONGLY SUGGEST INCLUSION OF THESE. I THINK THEY COULD BE SIGNIFICANT SOURCES, AND WE ARE FINDING THAT TO BE THE CASE ALREADY IN THE GRAND VALLEY.

LASTLY, I THINK YOU DID A GOOD JOB IN TRYING TO PAINT THE WHOLE PICTURE OF THE WHOLE IMPACT IN THE REGION FROM AIR POLLUTION FROM THESE PLANTS. (2) IN TERMS OF WATER, THE STRESS BEING ON THE DE-WATERING OF THE MINES PLUS THE LEACHING OF CONTAMINANTS, I FELT THAT THIS WAS A RATHER LIMITED VIEW OF THE WATER SITUATION. IT IS HARD TO PREDICT EXACTLY WHAT THE RESULTS ARE GOING TO BE FROM DE-WATERING, SINCE WE HAVEN'T HAD THE LONG-TERM THAT WE TRULY NEED BECAUSE THE CURRENT PROTOTYPE TRACTS HAVE NOT GIVEN US THAT. THE E.I.S. SHOULD CONTAIN MORE ANALYSES OF THE METHOD OF TRANSPORTING THE WATER AND THOSE AFFECTS. HOW WOULD ARSENIC CONTAMINATION OR STREAMS DRYING OUT AFFECT THE

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CATTLE INDUSTRY OR OTHER USERS IN THE REGION? THERE SHOULD BE MORE DETAILS ON IMPACTS IN THE WHITE RIVER, AND ALSO THERE'S NO MENTION IN THE E.I.S. ON WATER AVAILABILITY OR OWNERSHIP OF WATER RIGHTS AS FAR AS THE DEVELOPMENT OF THESE TRACTS. WHAT WOULD ACTUALLY BE POSSIBLE TO DEVELOP, GIVEN THE CONSTRAINTS ON WATER?

AS FAR AS WILDLIFE HABITAT, C-18 WOULD BE LESS DESTRUCTIVE IN TERMS OF ITS EFFECT ON HABITATS IF IT WERE LEASED. IT WOULD SEEM TO US THAT TAKING HABITAT OUT OF COMMISSION IS IN DIRECT CONFLICT TO WHAT THE STATE DIVISION OF WILDLIFE GOAL IS, WHICH IS INCREASING THE DEER HERD SIZE IN THE PICEANCE BASIN, WHICH IS A RESOURCE THAT THE AREA DOES BENEFIT FROM. (15)

I AM HAPPY YOU HAVE GIVEN SOME ESTIMATE AS TO THE CROP LANDS THAT WOULD BE TAKEN OUT OF PRODUCTION, MOSTLY DUE TO THE URBANIZATION THAT WOULD ACCOMPANY OIL SHALE DEVELOPMENT. I DO QUESTION YOUR STATISTICS AND YOUR FORMULA. GIVEN THE SITUATION WE HAVE HAD, FOR EXAMPLE, IN MESA COUNTY, YOUR FORMULA MAYBE CONSERVATIVE IN ITS ESTIMATES OF CROP LAND LOSS. I SUGGEST THAT FOR THE FINAL E.I.S. YOU TAKE A LOOK AT THE STATE AGRICULTURAL LANDS REPORT, AS WELL AS SOME OF THE COUNTY STATISTICS AND GET A BETTER IDEA OF CROP LANDS ALREADY TAKEN OUT OF PRODUCTION. (156)

ON THE SOCIO-ECONOMIC SECTION, WE WERE



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SOMEWHAT DISAPPOINTED. THERE ARE QUITE A FEW NEW REPORTS AND DOCUMENTS ON SOCIO-ECONOMIC PROBLEMS AND SOLUTIONS THAT HAVE COME OUT OVER THE LAST COUPLE OF YEARS, WHICH I DID NOT SEE LISTED OR UTILIZED IN THE DRAFT E.I.S. WE COULD HAVE SOMEONE DEVELOP SOME TESTIMONY FOR US ON SOCIO-ECONOMIC CONCERNS TO BE SUBMITTED, INCLUDING SOME REFERENCES THAT I THINK THE BLM COULD USE. SO I WON'T DWELL ON THAT, EXCEPT TO SAY AT THIS TIME THAT OUR POSITION IS, IF ANY OF THESE PROTOTYPE LEASES ARE LET, THIS TIME AROUND WE WOULD LIKE TO SEE SOME REAL SOCIO-ECONOMIC IMPACT MITIGATION AS A LEASE STIPULATION. IN OTHER WORDS, WE DON'T WANT JUST MONITORING THIS TIME INCLUDED IN THE LEASE. WE WANT SOME IMPACT PLAN WITH SOME KIND OF MONETARY BACK-UP TO IT. (124)

A FEW WORDS ON TECHNOLOGY. THERE'S SO MUCH UNTRIED TECHNOLOGY IN THE SHALE FIELD, THE FOUR CURRENT PROTOTYPES HAVEN'T PROVED MUCH IN TERMS OF PREFERRED RECOVERY METHODS OR RECLAMATION. SO I UNDERSTAND THAT THE BLM HAS VERY LITTLE TO GO ON. HOWEVER, I WAS SURPRISED TO SEE THE EMPHASIS IN THE E.I.S. ON THE MINE-ASSISTED IN SITU PROCESS. THE FEW EXPERIMENTS WITH IN SITU HAVEN'T BEEN ENCOURAGING, AND I THINK THE E.I.S. SHOULD LOOK MORE IN DEPTH AT THE OTHER KINDS OF OIL SHALE TECHNOLOGIES IN ADDITION TO IN SITU; BECAUSE OUR (19)

CONTENTION IS THAT THE COMPANIES ARE LIKELY TO GO FOR DIRECT MINING SURFACE RETORTING. THAT REALLY NEEDS TO BE ANALYZED.

LASTLY, ON THE TECHNOLOGY, THERE HAS TO BE SOME REAL ANALYSIS BEFORE GIVING OUT THESE LEASES OF THE MATURITY OF THESE OIL SHALE TECHNOLOGIES, AND TO MAKE SURE WE ARE REALLY LEASING SOMETHING AND THAT THIS TIME AROUND IT'S GOING TO PRODUCE SOMETHING.

I HAVE A COUPLE THINGS I WILL SKIP OVER HERE AND TRY TO WRAP UP. IN THE PAST, FRIENDS OF THE EARTH HAS BEEN SUPPORTIVE OF TESTING OF MULTIMINERAL TECHNOLOGY ON A LEASE. HOWEVER, WE DON'T FEEL LIKE WE CAN IN GOOD FAITH GO ALONG WITH THE CURRENT ATTEMPT TO LEASE MORE PROTOTYPE LEASES FOR THE FOLLOWING REASONS: I SAY AT THIS TIME, BECAUSE WE ARE NOT SAYING NEVER LEASE ANOTHER PROTOTYPE TRACT. HOWEVER, AT THIS TIME WE FEEL IT SHOULD NOT BE DONE. ONE, THERE IS A RECESSION, AND REALLY A LACK OF INTEREST ON THE PART OF THE COMPANIES. THEREFORE, WE REALLY FEEL LIKE THE LEASE SALE WILL NOT GENERATE ADEQUATE SALES PRICES. THEREFORE, THE OIL SHALE TRUST FUND MONEY WILL BE LESS FOR THE WESTERN SLOPE.

NUMBER TWO, WE DO NEED MORE REAL EXPERIENCE WITH OIL SHALE BEFORE DOING LEASING, AND THE CURRENT FOUR LEASES ARE NOT OPERATIONAL. I SUGGEST THE BLM GET





THOSE MOVING BEFORE WE DO MORE LEASING.

ALSO, THERE'S A PROGRAM THAT MR. SINGLAUB MENTIONED, PLUS THERE'S LEASING LEGISLATION IN CONGRESS. ALL OF THIS IS UNRESOLVED. THERE'S ABSOLUTELY NO WAY AT THIS POINT OF JUDGING THE MAGNITUDE AND TIMING OF OIL SHALE DEVELOPMENT. WHY ADD YET ANOTHER PROGRAM ON TOP OF IT?

NUMBER FOUR, THE E.I.S. CLEARLY SHOWS THAT JUST THE CURRENT PROJECTS, AND IT DEALT IN THERE WITH A LOT OF INFORMATION ON THE COLONY PROJECT -- IF THESE ARE DEVELOPED, WE WILL ALREADY HAVE INSURMOUNTABLE PROBLEMS WITH AIR QUALITY, AS WELL AS THE SOCIO-ECONOMIC PROBLEMS. IF THE OIL LEASE DOES SURVIVE AND THE BLM LEASES AND THE PRIVATE DEVELOPMENT DEVELOPS, WE HAVE A QUESTION ON WHETHER THE LEASE HOLDERS WILL BE ABLE TO GET P.S.D. PERMITS, CONSIDERING THE POLLUTION FROM THE OTHER PROJECTS. WE MIGHT BE SETTING UP A PAPER TIGER HERE AS FAR AS LEASING.

IF THE BLM DOES GO AHEAD WITH THIS, WE FEEL C-18 IS PREFERABLE FROM AN ENVIRONMENTAL STANDPOINT. HOWEVER, WE REALIZE THAT THOSE TWO TRACTS, C-11 AND C-18, WERE SELECTED ON THE BASIS OF INDUSTRY NOMINATION. THEREFORE, IF THERE'S BEEN NO REAL ANALYSIS OF THE PICEANCE BASIN AS FAR AS THE OPTIMUM NUMBER OF LEASES, THE OPTIMUM PLACEMENT OF LEASES, AND

THERE'S NO WAY OF DETERMINING THE CARRYING CAPACITY OF THE PICEANCE BASIN, I THINK IT'S BETTER TO HAVE THIS TYPE OF INFORMATION BEFORE WE GO AHEAD WITH THE PROTOTYPE, BUT ALSO WITH THE PROGRAMS.

LASTLY, THERE IS NO STIPULATION IN YOUR LEASE THAT STATES THAT THERE WILL BE MULTIMINERAL RECOVERY REQUIRED. WE ARE NOT TRYING TO DICTATE HERE WHAT KIND OF TECHNOLOGY THE COMPANY SHOULD USE, BUT THERE SHOULD BE A STIPULATION THAT IT'S MULTIMINERAL RECOVERY, IF THAT'S WHAT THIS PROGRAM IS ABOUT. THAT SHOULD BE IN THE LEASE. (27)

THAT'S ABOUT ALL I HAVE TO SAY, UNLESS YOU HAVE ANY QUESTIONS FOR ME. THANK YOU.

CURT SMITH: THANK YOU, CONNIE. MARK BUBRISKI?

MARK BUBRISKI: I AM MARK BUBRISKI. I AM THE IMPACT COORDINATOR HERE IN RIO BLANCO COUNTY. I WANT TO MAKE APOLOGIES FOR ALLEN JONES, THE CHAIRMAN OF THE COUNTY COMMISSIONERS, WHO UNFORTUNATELY CAME DOWN WITH A BAD CASE OF THE FLU OR SOMETHING THIS AFTERNOON. HE IS HOME TRYING TO RECOVER FROM THAT.

I HAVE A STATEMENT HERE THAT I WOULD LIKE TO SHARE WITH YOU TONIGHT. WE ARE GOING TO CONFINE OUR COMMENTS PRIMARILY TO THE SOCIO-ECONOMIC ASPECTS OF THE E.I.S. AGAIN, I WANT TO THANK YOU FOR THE OPPORTUNITY





HERE TO COMMENT. BEFORE OUTLINING THE COUNTY'S SPECIFIC CONCERNS REGARDING THE DATA AND ASSUMPTIONS USED IN THE SOCIO-ECONOMIC SECTIONS OF THE E.I.S., WE WOULD LIKE TO STATE THAT RIO BLANCO COUNTY DOES SUPPORT THE LEASING OF ADDITIONAL OIL SHALE TRACTS C-11 AND C-18, PROVIDED THAT THE COUNTY HAS SUFFICIENT OPPORTUNITY TO REVIEW AND COMMENT ON THE RELATED MITIGATION PLANS ASSOCIATED WITH ANY FUTURE LESS EAST.

ALSO THE COUNTY REQUESTS THE OPPORTUNITY TO ADDRESS FUTURE ADDITIONAL LEASES SUCH THAT IMPACTS FROM THOSE LEASES AND THOSE PROJECTS WOULD BE DISPERSED IN A TIMELY AND DILIGENT MANNER, SO AS TO MINIMIZE ANY (77) IMPACTS AFFECTING RIO BLANCO COUNTY. SPECIFICALLY, WE HAVE THE FOLLOWING COMMENTS. THE E.I.S. ESTIMATES THE PERCENTAGE OF POPULATION IMPACT ABOVE THE BASELINE GROWTH FOR DEVELOPMENT OF BOTH C-11 AND C-18 TRACTS TO BE 18 TO 20 PERCENT DURING THE PEAK YEAR 1988 IN RANGELY, WHILE IT DROPS TO 12 PERCENT FOR THE OPERATIONS IN 1993. FOR MEEKER, THE POPULATION IMPACT WOULD BE 60 TO 75 PERCENT DURING THE PEAK, AND 39 TO 42 PERCENT DURING OPERATIONS. OVERALL, THE POPULATION IMPACTS WOULD BE VERY SEVERE FOR MEEKER, WITH BOTH TRACTS DEVELOPED; AND SEVERE WITH ONLY DEVELOPMENT.

WHILE FOR RANGELY THE DEGREE OF SEVERITY WOULD BE SEVERE WITH BOTH AND MODERATE WITH ONE. THE (228)

E.I.S. STATES THAT THE GROWTH RATE FOR MEEKER IN THE BASELINE CASE IS FIVE TO SEVEN PERCENT ANNUAL GROWTH, WHICH IS MANAGEABLE. WE BELIEVE ANYTHING OVER THREE PERCENT ANNUAL GROWTH IS CONSIDERED BY MOST SOCIO-ECONOMIC AUTHORITIES AS SEVERE IMPACT. UNDER THE HIGH SCENARIOS OF DEVELOPMENT OF BOTH C-11 AND C-18, MEEKER WOULD GROW FROM 4500 IN 1983 TO A PEAK OF 10,500 IN 1989, FOR AN ANNUAL GROWTH RATE OF 20 PERCENT.

THE E.I.S. GOES ON TO STATE THAT MEEKER WOULD EXPERIENCE SEVERE QUALITY OF LIFE DETERIORATION UNDER THE LOW SCENARIO, DEVELOPMENT OF ONE TRACT, AND VERY SEVERE DETERIORATION WITH BOTH TRACTS DEVELOPED. RANGELY WOULD BE SEVERELY IMPACTED WITH BOTH DEVELOPED. CASE, IT IS UNLIKELY THAT THE INCREASED REVENUES RECEIVED BY COMMUNITY WOULD OFFSET THE CAPITAL AND OPERATING COSTS THAT WOULD BE NECESSITATED BY SUCH RAPID GROWTH, AND HEAVILY IMPACTED TOWNS WOULD NEED LARGE INFUSIONS OF ASSISTANCE." (228)

THERE IS NO SUGGESTION IN THE E.I.S. AS TO WHO WOULD PROVIDE THE ASSISTANCE OR HOW THESE IMPACTS WOULD BE MITIGATED.

I HAVE ANOTHER CONCERN REGARDING THE PERCENTAGE OF IN-MIGRATION WORKERS. THE E.I.S. ASSUMES THAT THE PERCENT OF IN-MIGRATION CONSTRUCTION WORKERS WILL BE 50 TO 75 PERCENT. THIS ASSUMES THAT THERE WILL





BE A HIGH DEGREE, ROUGHLY 50 TO 30 PERCENT, OF EXISTING UNEMPLOYED LABOR FORCE OR THAT THE POTENTIAL FOR TRADE UNION REQUIREMENTS WILL BE MINIMAL. NO ONE KNOWS WHAT THE SITUATION WILL BE WITH THAT. THE ASSUMPTION THAT THERE WILL BE A FAIRLY SIGNIFICANT PERCENTAGE OF LOCAL EMPLOYABLE WORKERS MINIMIZES THE POTENTIAL O/M COSTS AND POTENTIAL CAPITAL COSTS OF INFRASTRUCTURE DEVELOPMENT. ALSO, HOUSING NEEDS WOULD BE FALSELY MINIMIZED AS WELL.

IN SUMMARY, THE E.I.S. ASSUMES A MARGINAL DEGREE OF IN-MIGRATION, HIGH PERCENT OF EXISTING LABOR FORCE, AND THUS ASSUMES A REDUCED NEED FOR INFRASTRUCTURE DEVELOPMENT AND OPERATING COSTS. (131)

A COUPLE OF ADDITIONAL STATEMENTS MADE IN THE E.I.S. WE BELIEVE ARE INACCURATE. THE E.I.S. STATES THAT A SURVEY IN MEEKER OF 350 RESIDENTS IN 1975 FOUND 51 PERCENT PREFERRED THE ESTABLISHMENT OF A NEW TOWN CLOSE TO THE MINE SITES IN PICEANCE. THIS SHOULD (2) BE UPDATED OR DELETED FROM THE E.I.S. THE E.I.S. STATES THAT THE RANGELY HOSPITAL AND SCHOOLS HAVE LOW OCCUPANCY RATES THAT CAN ABSORB CONSIDERABLE GROWTH. THE E.I.S. DOES NOT QUALIFY "CONSIDERABLE" AND MAKES NO OTHER CAPACITY STATEMENTS REGARDING OTHER FACILITIES IN MEEKER AND RANGELY. (130)

THE RANGELY SCHOOL DISTRICT IS CURRENTLY

EXPERIENCING SOME OVERCROWDING IN THE ELEMENTARY AND MIDDLE SCHOOL. THE E.I.S. STATEMENT IS INACCURATE. (229)

IN CONCLUSION, THE E.I.S. MAKES SEVERAL BROAD STATEMENTS RELATED TO WHAT THE EXPECTED IMPACTS MIGHT BE, BUT OFFERS NO CONCRETE SOLUTIONS AS TO HOW THESE PROBLEMS, ESPECIALLY FISCAL IMPACTS, WILL BE ADDRESSED. RIO BLANCO COUNTY HOPES THAT THE INTERIOR DEPARTMENT THROUGH THE BLM RECOGNIZES THE NEED FOR POTENTIAL LESSEES TO ACTIVELY OR DILIGENTLY MITIGATE THE SOCIAL AND ECONOMIC IMPACTS TO BE FELT IN MEEKER AND RANGELY. TO THIS END, WE REQUEST THAT AS PART OF ANY FUTURE LEASING DECISIONS, THE BLM WOULD REQUIRE ALL LESSEES TO MEET ALL REQUIREMENTS OF THE COUNTY PERMITTING PROCESS PRIOR TO THE ISSUANCE OF THE FEDERAL PERMIT. (78)

ONCE AGAIN, THANK YOU FOR THE OPPORTUNITY TO COMMENT ON THE DRAFT PROTOTYPE E.I.S.

CURT SMITH: THANK YOU, MARK. JUDY GETCHELL?

JUDY GETCHELL: NOT AT THIS TIME.

CURT SMITH: LEE MERKEL?

LEE MERKEL: I AM GARFIELD COUNTY'S IMPACT COORDINATOR. THE GARFIELD COUNTY COMMISSIONERS REQUESTED THAT I COME AND MAKE A BRIEF COMMENT TONIGHT TO INDICATE THEIR CONCERNS REGARDING A POTENTIAL





LEASING OF FEDERAL LANDS IN A NORTHWESTERN COLORADO AREA SUCH AS C-11 AND C-18.

THE GARFIELD COUNTY COMMISSIONERS WOULD LIKE TO ONCE AGAIN REGISTER THEIR CONCERNS REGARDING THE ISSUANCE OF ADDITIONAL OIL SHALE LEASES IN FEDERAL LANDS IN NORTHWESTERN COLORADO. MORE SPECIFICALLY, THEIR CONCERNS CENTER AROUND THE PHASING OF THE DEVELOPMENT AND THE INPUT THAT LOCAL ELECTED OFFICIALS WILL BE ALLOWED REGARDING THE SOCIO-ECONOMIC EFFECTS OF SUCH LEASING.

OIL SHALE DEVELOPMENT ON FEDERAL LANDS IN ADDITION TO THAT WHICH IS ALREADY BEING DEVELOPED AND PLANNED ON PRIVATE LAND IN REGION 11 COULD MEAN ADVERSE SOCIO-ECONOMIC IMPACTS ON LOCAL GOVERNMENT JURISDICTIONS. WITH FOUR OIL SHALE PROJECTS IN THE EARLY PHASES OF DEVELOPMENT IN RIO BLANCO AND GARFIELD COUNTIES IN 1981, SOME COMMUNITIES WERE EXPERIENCING ANNUAL GROWTH RATES IN EXCESS OF 25 PERCENT. THE BOARD, THEREFORE, REQUESTS THAT LOCAL GOVERNMENTS BE GIVEN THE OPPORTUNITY TO PROVIDE SIGNIFICANT INPUT INTO THE SOCIO-ECONOMIC IMPACT MITIGATION PROGRAMS WHICH SHOULD BE REQUIRED AS CONDITIONS OF THE ISSUANCE OF SUCH LEASES. THANK YOU. (124)

CURT SMITH: THANK YOU, LEE. ED GREENLEAF? I WANT TO MAKE A STATEMENT. YOU CAME IN

AFTER THE INTRODUCTION. WE ARE LIMITING EACH STATEMENT TO EIGHT MINUTES.

ED GREENLEAF: THAT'S FINE. I AM A RESIDENT OF PITKIN COUNTY, AND ALSO AS A PROFESSIONAL I AM A SOCIAL WORKER. I AM NOT HERE TO SPEAK FOR ANY PROFESSIONAL GROUP, MERELY AS A CITIZEN.

WHAT I WANTED TO ADDRESS ALSO HAD TO DO WITH THIS SOCIO-ECONOMIC STATEMENT THAT WAS MADE IN THE F.I.S. I ALSO FIND THOSE STATEMENTS TO BE SOMEWHAT LIMITED IN TERMS OF THE RESULTS THAT THEY HAVE INDICATED THEY FOUND. FOR INSTANCE, IN CHAPTER FOUR THEY SPEAK ABOUT CERTAIN GROUPS THAT WERE FORMED IN THE MEEKER AND RIFLE AREA THAT WERE ADVISORY HUMAN RESOURCE COUNSEL TYPE THINGS THAT WERE SET UP TO LOOK AT WHAT THE IMPACT WOULD BE ON SOCIO-ECONOMICS IN THAT AREA.

WHAT I SEEM TO HAVE TROUBLE WITH IS THE FACT THAT, AT LEAST IT'S NOT INDICATED OTHERWISE, THAT THESE WERE BASICALLY AD HOC GROUPS THAT WERE FORMED BY INTERESTED CITIZENS IN THE COMMUNITY. THE POINT I AM TAKING IS THAT PERHAPS IT IS NOT INCUMBENT UPON THESE GROUPS, ALTHOUGH THEY ARE DEFINITELY INTERESTED CITIZENS THAT WANT TO KNOW WHAT'S HAPPENING IN THEIR COMMUNITY, BUT THERE MAYBE SOME QUESTION AS TO HOW THOROUGH THEY WERE ABLE TO GATHER THE INFORMATION LEADING TO THEIR COMMENTS, WHICH WOULD SAY THAT THERE (230)





IS GOING TO BE SEVERE IMPACT IN THOSE COMMUNITIES. HAVE THEY REALLY HAD AN OPPO[illegible] TO LOOK AT ALL OF THE CHARACTERISTICS OR THE CONDITIONS THAT WOULD GO INTO MAKI[illegible]

[illegible] SAYING IS, IT MIGHT BE MORE INCUMBENT ON THE GOVERNMENT TO CONDUCT THOSE SORTS OF SURVEYS USING THEIR SCIENTIFIC EXPERTISE TO GET AT THOSE KINDS OF ANSWERS AND REALLY DO A THOROUGH JOB.

I ALSO NOTED ON PAGE 167 IN HERE THAT THE CONCLUSIONS WERE THAT THE QUALITY OF LIFE WAS GOING TO BE KIND OF A TRADE-OFF FOR PEOPLE. THERE WOULD BE SOME PEOPLE WHO WOULD WIN AND SOME PEOPLE WOULD LOSE. SOME PEOPLE, THE OLDTIMERS WOULD HAVE TO GIVE UP CERTAIN THINGS THAT THEY WERE USED TO IN THE AREA. THERE WOULD BE SOME THINGS THAT THE NEWCOMERS WOULD HAVE TO GIVE UP AS THEY CAME INTO THE NEW AREA. I FIND THAT QUESTIONABLE IN THE SENSE THAT THERE'S NO QUANITIFCATION OF THAT. TO WHAT DEGREE IS THAT GOING TO HAPPEN? TO WHAT DEGREE ARE THOSE KINDS OF THINGS BEING TAKEN INTO CONSIDERATION IN THIS PLAN? (231)

SO I AM HOPING THAT IN THE DEVELOPMENT AND FINAL ADOPTION OF THIS F.I.S. THAT THERE IS GOING TO BE SOME KIND OF REQUIREMENT ON THE PART OF THE OIL SHALE COMPANIES WHO ARE EVENTUALLY LEASING THESE TRACTS TO AFFORD SOME KIND OF FINANCIAL RESPONSIBILITY TO MAKE (124)

436

M 30

SURE THAT THESE PROGRAMS ARE DEVELOPED. THANK YOU.

CURT SMITH: THANK YOU, ED. DEE KNAPP?

DEE KNAPP: I AM ALSO HERE JUST TO EXPRESS MY CONCERNS AS A PRIVATE CITIZEN. FIRST OF ALL, BEFORE I START MY TESTIMONY, I DID WANT TO MAKE A COMMENT ABOUT THE FACT THAT THE HEARINGS ON THIS PARTICULAR E.I.S., AS WELL AS THE RESOURCE MANAGEMENT PLAN AT THE SAME TIME, IS RATHER CONFUSING FOR THE MAJORITY OF THE CITIZENS HERE. I DON'T KNOW IF THAT'S BEEN ADDRESSED BEFORE, BUT IT'S VERY DIFFICULT TO UNDERSTAND EXACTLY WHAT WAS GOING ON AND WHAT WE WERE SUPPOSED TO ADDRESS AT THIS TIME WITH BOTH OF THESE HEARINGS TOGETHER. SO I WILL DO THE BEST I CAN TO ADDRESS WHAT I THINK I AM SUPPOSED TO BE ADDRESSING.

I UNDERSTAND THAT THE PUBLIC INVOLVEMENT SCHEDULE FOR THE R.M.P. FOR THE PICEANCE BASIN HASN'T EXACTLY BEEN SET OUT YET. I WOULD LIKE TO SAY THAT I THINK THAT THAT'S VERY IMPORTANT THAT IT IS SET OUT, THAT THE CITIZENS KNOW WELL IN ADVANCE WHEN THAT PUBLIC PARTICIPATION PROCESS WILL OCCUR, AND THAT IT'S VERY IMPORTANT THAT CITIZENS GET A CHANCE TO COMMENT ON THESE THINGS, AND THAT WE HAVE MORE PUBLIC PARTICIPATION AND NOT LESS. I UNDERSTAND, IT SEEMS THE TREND THAT IS GOING IS THAT THERE IS GOING TO BE LESS AND LESS PUBLIC PARTICIPATION INSTEAD OF MORE AND MORE.



M 31

AS FAR AS THE PROTOTYPE E.I.S. LEASING GOES, I WANTED TO REITERATE AND EMPHASIZE SOME OF THE COMMENTS THAT WERE MADE BY CONNIE ALBRECHT OF FRIENDS OF THE EARTH. FIRST OF ALL, CONSIDERING THE OVERALL TIMELINESS OF OIL SHALE LEASING TO THE CURRENT RECESSION, I DON'T UNDERSTAND THAT MYSELF. (16) I DON'T UNDERSTAND WHEN EXXON CAME INTO THIS AREA AND SUDDENLY PULLED OUT, SOMEHOW THE GOVERNMENT IGNORED THAT. THE WHOLE PROCESS GOES ON. IT WOULD SEEM TO MAKE MORE SENSE, IF THESE WERE GOVERNMENT LANDS, THAT THEY BE LEASED LIKE A COMMUNITY LANDLORD WOULD LEASE THEIR OWN PRIVATE LANDS, AT A TIME WHEN THE MOST MONEY CAN BE GOTTEN OUT OF IT, WHEN THE INDUSTRY SEES THAT THEY CAN MAKE A GOOD PROFIT, AND EVERYONE CAN BENEFIT BY IT.

I WOULD ALSO LIKE TO ADDRESS SOME OF THE SOCIO-ECONOMIC STIPULATIONS THAT CONNIE ALBRECHT MENTIONED SHOULD BE IN THE LEASE. I FEEL THIS IS VERY IMPORTANT, THAT THE COMPANIES ARE HELD RESPONSIBLE FOR THE SOCIO-ECONOMIC EFFECTS IN THE AREA. I WOULD HOPE THAT IN THE LEASE AS WELL AS IN ANY RESOURCE MANAGEMENT PLAN, THAT THERE IS CRITERIA PROVIDING FOR WHO WILL PAY FOR THE INCREASED SOCIAL AND HUMAN SERVICES THAT WILL BE NECESSARY. (124)

I WOULD ALSO LIKE TO SEE ADDRESSED WHAT HAPPENS WHEN THE ECONOMY NOT ONLY BOOMS BUT BUSTS. IT (2)

SEEMS LIKE IN THE E.I.S. IT MAKES THE CONCLUSION THAT EVERYONE WILL BENEFIT IN THE LONG RUN, THAT IF WE JUST HANG ON LONG ENOUGH THAT EVERYONE CAN SEE THIS THROUGH AND IT WILL BE GOOD FOR EVERYONE. (2)

HOWEVER, OIL SHALE, LIKE ANY OTHER MINERAL, IS FINITE. AT SOME TIME THE ECONOMY IS GOING TO BUST. IT WON'T BOOM AND BOOM. THERE IS A POINT WHERE IT WILL BUST OR THERE'S A POINT WHERE THE INDUSTRY PLAINLY PULLS OUT, AS EXXON DID. I WOULD LIKE TO SEE THIS ADDRESSED.

WHAT WILL HAPPEN THEN? WHAT HAPPENS TO THE PEOPLE? WHAT HAPPENS TO THE PEOPLE WHEN THEY COME INTO A COMMUNITY AND THEY ARE THERE, AND THEY DON'T KNOW WHERE THEY ARE GOING TO RELOCATE, AND THERE ARE NO JOBS AND THERE ARE NO TAXES THAT ARE PROVIDING FOR THE HUMAN SERVICES THAT ARE NECESSARY FOR THESE PEOPLE BECAUSE THE INDUSTRY IS GONE?

I WOULD LIKE TO EMPHASIZE THAT WATER QUALITY AND AIR QUALITY NEEDS TO BE PROTECTED. THESE ARE RESOURCES WHICH ARE ALSO FINITE. IF WE DON'T PROTECT THEM, AT SOME POINT IN THE FUTURE WE WILL FIND THAT WE DON'T HAVE ANY MORE. WATER SUPPLY IS SOMETHING IN AN ARID AREA, THE WATER IS SCARCE AND IN MANY AREAS THE RIVERS ARE ALREADY OVER-ALLOCATED.

WHAT ABOUT AGRICULTURE? WHAT ABOUT THE







PEOPLE THAT NEED THIS WATER? WHAT YOU ARE TALKING ABOUT, MINE DE-WATERING. FURTHER DOWN THE LINE, ALL THESE RIVERS AND CREEKS ARE TRIBUTARIES TO GREATER RIVERS GOING TO CALIFORNIA AND ARIZONA. PEOPLE FURTHER DOWN THE LINE NEED THIS WATER ALSO. WE CAN'T USE IT ALL UP HERE.

BASICALLY THAT'S THE EXTENT OF MY TESTIMONY, EXCEPT THAT I WOULD LIKE TO SAY THAT I SUPPORT THE POSITION THAT THE FRIENDS OF THE EARTH TAKES IN TERMS OF THIS E.I.S. AND THE RESOURCE MANAGEMENT PLAN.

CURT SMITH: DEE, COULD YOU TELL US WHERE YOU ARE FROM?

DEE KNAPP: I'M SORRY, I AM FROM ASPEN.

CURT SMITH: JUDY GETCHELL, WOULD YOU LIKE TO MAKE A STATEMENT AT THIS TIME?

JUDY GETCHELL: I AM JUDY GETCHELL FROM MEEKER, AN UNEMPLOYED OIL SHALE WORKER. I WOULD MOVE, BUT I OWN MY OWN PROPERTY AND I OWN -- IT'D COST ME MORE TO MOVE THAN IT WOULD TO STAY HERE AND STARVE, I THINK.

I WOULD LIKE TO SAY THAT THE DEVELOPMENT OF THE OIL SHALE BY TAX MONEY, BY PRIVATE INDUSTRY, OR HOWEVER, IS SOMETHING THAT WE HAVE BEEN PROMISED, AND IT WAS PROMISED IN THE LATE 1800'S. IT'S BEEN PROMISED IN THE 1920'S, 1940'S. WE FINALLY SAW IT THEN. GOSH,

WE HAVE A MONUMENT OUT THERE. IT'S CALLED THE HEADFRAMES AT C-B TRACT.

IF SOMETHING ISN'T DONE, AND WE DON'T DO SOMETHING TO BRING PEOPLE AND SHOW THAT WE DO HAVE FAITH IN THE GOVERNMENT AND WE DO HAVE FAITH IN OUR OWN ECONOMY, THEN WE MIGHT AS WELL CLOSE THE DOORS TO RIO BLANCO COUNTY, GARFIELD COUNTY, MESA COUNTY.

LOGAN WASH OUT OF DEBEQUE WAS PRIVATE BY OCCIDENTAL OIL SHALE, AND THE TECHNOLOGY HAS TRIED AND PROVED THAT THEIR MODIFIED IN SITU PROCESS DOES WORK. IT IS STILL WORKING. IS IT NOT, TOM? TOM? IT IS STILL FUNCTIONING, AS FAR AS YOU KNOW?

LAST I HEARD, THEY WERE STILL GOING AT IT DOWN THERE. THEY HAD NOT COMPLETELY CLOSED THEIR DOORS.

IF A SMALL RESEARCH AND DEVELOPMENT PROJECT SUCH AS LOGAN WASH IS STILL FUNCTIONING AND STILL CAPABLE OF PAYING THE BILLS AND KEEPING THAT BRANCH OPEN, THEN I THINK THAT SOME PEOPLE ARE NOT LOOKING AT THE TECHNOLOGY THAT OCCIDENTAL HAS PUT INTO LOGAN WASH.

I WOULD LIKE TO SEE IT GO, AND I THINK THAT MANY OF THE THINGS THAT ARE LOOKED AT IN THIS MEETING AS WELL AS THE REST OF THEM REALLY DO NEED A LITTLE MORE CLEARING UP AS TO WHAT IS GOING TO HAPPEN WHEN THE PEOPLE DO COME IN. THERE ARE A LOT OF US WHO ARE





SITTING HERE WAITING, HOPING THAT MAYBE SOMETHING WILL COME ALONG THAT WE CAN OPEN UP AGAIN.

CURT SMITH: THANK YOU, JUDY. ARE THERE ANY OTHERS IN THE AUDIENCE THAT WOULD LIKE TO MAKE A FORMAL STATEMENT AT THIS TIME?

TOM EASLEY: I MUST HAVE MISSED THE REGULAR LIST. I THOUGHT I CHECKED OFF THE APPROPRIATE COLUMN THERE. MY NAME IS TOM EASLEY. I AM FROM STEAMBOAT SPRINGS, COLORADO. I AM HERE REPRESENTING THE NORTHWEST RIVERS ALLIANCE, WHICH IS A CITIZENS GROUP BASED PRIMARILY IN THE YAMPA RIVER VALLEY, AND IS CONCERNED WITH THE RESOURCE ISSUES. I AM ALSO ON THE WESTERN EXECUTIVE COMMITTEE OF THE WESTERN COLORADO CONGRESS, WHICH IS A COALITION OF CITIZENS AND CONSUMER GROUPS DEDICATED TO THE PRESERVATION OF SUSTAINABLE ECONOMIES AND A GOOD QUALITY OF LIFE IN WESTERN COLORADO.

I WOULD LIKE TO START OUT BY SAYING, JUST LOOKING AT TODAY'S SITUATION, IT'S PRETTY HARD FOR ME TO BELIEVE THERE IS EVEN SERIOUS TALK OF NEW PROTOTYPE LEASES. ON THE ONE HAND, WE ALREADY HAVE MORE THAN WE CAN HANDLE. AS I SAY, I AM FROM STEAMBOAT SPRINGS. I JUST RECEIVED SOMETHING IN THE MAIL YESTERDAY FROM THE COLORADO DEPARTMENT OF HEALTH WHICH TELLS ME IN TERMS OF TOTAL SUSPENDED PARTICULATES, WE ARE ALREADY MORE

THAN DOUBLE THE NATIONAL AMBIENT AIR QUALITY STANDARDS.

JOHN MENTIONED EARLIER THAT IF WE HAVE NO ACTION, AS WE ARE RECOMMENDING, THEN THE SULPHUR DIOXIDE LEVELS IN THE MT. ZIRKEL WILDERNESS AREA, WHICH IS REAL CLOSE TO STEAMBOAT SPRINGS, WILL BE DOUBLE THE STANDARDS ALSO. I THINK IT'S BEEN PRETTY WELL COVERED, THE POTENTIAL IMPACTS ON THE RIFLE, MEEKER, PARACHUTE AREA. IT SEEMS TO ME LIKE WHAT WE ARE BEGINNING TO TALK ABOUT HERE IS THE WESTERN SLOPE BEING THE INDUSTRIAL PARK OF THE WEST. MOST PEOPLE I HAVE TALKED TO HAVE NO DESIRE FOR THAT SORT OF SITUATION TO OCCUR.

ON THE OTHER HAND, WE ALREADY HAVE A PROTOTYPE LEASING PROGRAM THAT HAS BEEN PRETTY MUCH OF A FAILURE. NONE OF THE FOUR ORIGINAL PROTOTYPE LEASES HAVE BEEN DEVELOPED, AND WHILE THE IMMEDIATE AREA HERE HAS PRETTY WELL SURVIVED THE RECENT BUST, WE BEGIN TO WONDER HOW MANY OF THESE BOOM AND BUST CYCLES THIS AREA CAN SUSTAIN AND SURVIVE.

I WOULD LIKE TO MAKE IT CLEAR, WE ALWAYS SUPPORTED THE PROTOTYPE LEASING DEMONSTRATION. AS FAR AS I CAN SEE, THE MAIN THING WE HAVE HAD DEMONSTRATED SO FAR, OIL SHALE SEEMS LIKE A GOOD IDEA, BUT THERE DOESN'T SEEM TO BE AN ECONOMICAL WAY TO DO IT.

BEYOND ALL THAT, THIS WAS RAISED EARLIER, IT SEEMS TO ME LIKE WE HAVE A CLASSIC CART BEFORE THE





HORSE SYNDROME GOING ON HERE. EVEN HERE TONIGHT WE ARE TALKING ABOUT THE LEASING PROGRAM BEFORE WE ARE TALKING ABOUT THE RESOURCE MANAGEMENT PROGRAM. THAT TO ME DOESN'T MAKE REALLY GOOD PLANNING SENSE.

IN THE END, I THINK THE MOST IMPORTANT FACET OF THE OIL SHALE LEASING PROGRAM IS ITS IMPLICATIONS FOR THE FUTURE. THE ENERGY DEVELOPMENT MAY BE APPROPRIATE, BUT BEFORE WE START EVEN MORE ADVERSELY AFFECTING SUSTAINABLE ECONOMIES LIKE AGRICULTURE, HUNTING AND TOURISM, WE BETTER MAKE SURE IT IS WORTH IT. JUST READING SOMETHING FROM THE DRAFT E.I.S. HERE CONCERNING WATER QUALITY, THIS IS A QUOTE -- IT SAYS, "THE LOCATION OF THE TWO TRACTS, MEANING C-18 AND C-11, IS ONE OF THE WORST PLACES IN PICEANCE BASIN IN TERMS OF WATER IMPACTS," SINCE THEY STRADDLE TWO EXTREME BASINS.

IT GOES ON TO SAY IN PICEANCE CREEK THERE WOULD BE PERIODS, POTENTIALLY PERIODS OF NO FLOW AND YELLOW CREEK WOULD BE DRY 50 PERCENT OF THE TIME. I THINK WE REALLY NEED TO HAVE A LOOK AT THAT BEFORE WE START DOING NEW LEASES AND MAKE SURE IT IS WORTH IT. I DON'T THINK WE ARE AT THAT POINT RIGHT NOW.

SO I SAY, LET'S HAVE NO MORE LEASES AT THIS TIME. LET'S GET ON WITH THE DEVELOPMENT OF A THOROUGH RESOURCE MANAGEMENT PLAN. THANK YOU.

CURT SMITH: THANK YOU, TOM. ARE THERE ANY OTHERS THAT WOULD LIKE TO MAKE A STATEMENT? YES?

JOHN OSSE: I'M JOHN OSSE, ADMINISTRATOR OF PIONEERS HOSPITAL. I HADN'T PLANNED ON SPEAKING THIS EVENING. I MOSTLY WANTED TO SEE WHAT WAS GOING ON IN OIL SHALE, BUT A NUMBER OF CONCERNS HAVE ARISEN AS A RESULT OF SOME OF THE REMARKS.

I HAVEN'T READ THE PLAN. GOING THROUGH THE INDEX, I DON'T SEE ANYTHING ABOUT MEDICAL CARE IN TERMS OF ADDRESSING THE SOCIAL AND ECONOMIC ASPECT. IN A TOWN THIS SIZE IN MEEKER, WE ARE IT IN TERMS OF A HOSPITAL, IN TERMS OF EMERGENCIES. THE HOSPITAL IS 17 BEDS WITH A 25-BED NURSING HOME. OF THE 17 BEDS, 11 ARE GENERAL MEDICAL BEDS; FOUR ARE OB. BEDS OR OBSTETRIC BEDS, AND TWO ARE INTENSIVE CARE BEDS. WHAT THAT MEANS, WE HAVE ALMOST NO FLEXIBILITY IN TERMS OF MEETING ANY SUDDEN SURGE IN POPULATION.

FOR EXAMPLE, DURING HUNTING SEASON WE CAN HAVE A BRIEF PERIOD OF 100 PERCENT OCCUPANCY, AND THEN HAVE NO PATIENTS. THIS IS SIGNIFICANT WHEN YOU CONSIDER THAT THE PLANNING TIME, ONCE THE NEED IS ADDRESSED AND YOU SEE YOU HAVE A PROBLEM, WE HAVE THREE YEARS BEFORE WE CAN EVEN START CONSTRUCTION. YOU CAN START FOR THE PLANNING PHASE, THE ARCHITECTURAL PHASE, THE FINANCING PHASE, THE REGULATORY PHASE. HOSPITALS (118)





ARE USUALLY MORE REGULATED THAN NUCLEAR POWER PLANTS, INCLUDING OUR LITTLE HOSPITAL UP HERE.

ASSUMING EVERYTHING GOES PERFECTLY WELL, YOU MAY GET DONE IN TWO AND A HALF YEARS, AND THEN YOU CAN START CONSTRUCTION AND THAT CAN TAKE ANOTHER YEAR, DEPENDING ON THE TIME OF YEAR YOU START.

I WOULD LIKE TO SEE SOMETHING ADDRESSED IN THE SOCIO-ECONOMIC ASPECT OF THIS PLAN. WE HAVE ALSO GOT A PROBLEM IN TERMS OF MANPOWER RECRUITMENT, PHYSICIAN RECRUITMENT, IN TERMS OF THESE DEMANDS COMING UP. IT WOULDN'T TAKE VERY MUCH TO HAVE PEOPLE IN OUR HALLS.

WE HAVE STARTED A PLANNING PROCESS, BECAUSE APPROXIMATELY, AS I RECALL, ABOUT 42 PERCENT OF OUR PATIENTS WERE FROM ENERGY COMPANIES, THAT INCLUDED THEIR FAMILIES. NOW WE HAVE A BUST AND FORTUNATELY WE DIDN'T DO ANYTHING. WE DIDN'T BUILD ANYTHING NEW AS A RESULT OF THIS ANTICIPATED BOOM, OR WE WOULD BE IN REAL TROUBLE. (118)

IT'S GOING TO BE A VERY INTERESTING PLAN BECAUSE WE WANT TO ADDRESS WHAT WE CAN DO NOW IF THE ENERGY PEOPLE COME IN. A FIVE PERCENT POPULATION INCREASE COULD IMPACT US VERY SEVERELY. SO I WOULD ASK THAT THIS BE ADDRESSED TO GIVE US AS MUCH OPPORTUNITY AS POSSIBLE, BECAUSE WE ARE GOING TO BE IMPACTED VERY

QUICKLY.

WITH THREE OR FOUR YEARS BEFORE WE CAN ADDRESS THAT NEED, ASSUMING EVERYTHING GOES RIGHT, WILL PRESENT A REAL HARDSHIP. WE ARE TALKING ABOUT CONSTRUCTION WORKERS. YOU ARE TALKING ABOUT HIGH TRAUMA. I DISCUSSED IT WITH MY NURSING STAFF, MEDICAL STAFF AND SOME OF THE LONG-TERM RESIDENTS HERE. I AM TOLD TWO OR THREE YEARS AGO WE HAD SOME CREWS COMING THROUGH WORKING ON POWER LINES, WHICH I UNDERSTAND WILL BE HERE THIS FALL, AND JUST THAT NUMBER IMPACTED OUR EMERGENCY ROOM, TAXED US SEVERELY.

YOU HAVE A LOT MORE ACCIDENTS, INDUSTRIAL ACCIDENTS, CAR ACCIDENTS. THEY TEND TO BE A LITTLE ON THE WILD SIDE, I AM TOLD. WE ARE NOT TALKING ABOUT A LOT OF FAMILIES, NECESSARILY. SO WE WOULD SURE APPRECIATE AS MUCH WARNING AS YOU CAN GIVE US, BASED ON PAST EXPERIENCE IN OUR COMMUNITY.

CURT SMITH: ARE THERE ANY OTHERS WHO WOULD LIKE TO MAKE A STATEMENT AT THIS TIME?

ONE THING, WRITTEN COMMENTS ARE DUE IN ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT BY SEPTEMBER SEVENTH. THEY SHOULD BE SENT HERE TO THE OFFICE IN MEEKER IN CARE OF JOHN SINGLAUB, THE OIL SHALE PROJECT'S TEAM LEADER, WHITE RIVER RESOURCE AREA, BOX 928, MEEKER.





AGAIN, ANY OTHER STATEMENTS? IF NOT, THE HEARING ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ON PROTOTYPE OIL SHALE LEASING IS HEREBY ADJOURNED.

(CONCLUDED AT 8:15 P.M.)

DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROTOTYPE OIL SHALE LEASING PROGRAM

BUREAU OF LAND MANAGEMENT PARTICIPANTS:
CURT SMITH, AREA MANAGER
JOHN SINGLAUB, OIL SHALE PROJECT TEAM LEADER

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TRANSCRIPT OF PROCEEDINGS AT THE PUBLIC MEETING, HELD AT THE RAMADA INN CONVENTION CENTER, GRAND JUNCTION, COLORADO, ON THURSDAY, AUGUST 26, 1982, COMMENCING AT APPROXIMATELY 7:00 P.M., BEFORE ME, KAREN WITEK, CERTIFIED SHORTHAND REPORTER IN AND FOR THE STATE OF COLORADO.





BREAK.

WITH THAT, WE WILL CALL THE FIRST PERSON THAT WOULD LIKE TO MAKE A STATEMENT, BARBARA RHOADS.

BARBARA RHOADS: I AM PARTICULARLY CONCERNED ABOUT THE --

CURT SMITH: BARBARA, WOULD YOU PLEASE COME FORWARD SO THE COURT REPORTER CAN GET IT? STATE YOUR NAME AND WHO YOU REPRESENT. IF YOU WOULD COME UP TO THE LEFT SO SHE CAN BE SURE TO HEAR YOU.

BARBARA RHOADS: I AM PARTICULARLY CONCERNED ABOUT AGRICULTURE AND THE KIND OF IMPACT, AND HOW MUCH IMPACT AGRICULTURE CAN STAND AND STILL EXIST. I AM NOT -- I AM A HOUSEWIFE AND MY HUSBAND IS IN THE SCHOOL BUSINESS. I HAVE SIX TOMATO PLANTS, BUT I AM A CONSUMER AND I AM INTERESTED IN SEEING A LOT OF COMPETITION.

IN OTHER WORDS, IF WE ELIMINATE THE AGRICULTURAL AREAS -- SURE, THERE ARE OTHERS, BUT THAT IN TURN COULD DRIVE UP THE PRICES AND JUST ELIMINATE ONE MORE SECTION OF THE FOOD CHAIN. IN REGARDS TO AGRICULTURE, PARTICULARLY THE WATER -- NOT JUST THE PEOPLE THAT WOULD COME IN, BUT THE WATER, SAY WE HAD A DROUGHT. WOULD A LARGE WEALTHY OIL COMPANY BE ABLE TO COMMANDEER THE WATER? SAY IF WE -- HYPOTHETICALLY, IF WE HAD ONE OF OUR LITTLE SKIRMISHES SOMEWHERE ELSE ON (232)

THE GLOBE, THEY CAN SAY THIS IS A NATIONAL EMERGENCY AND WE CAN TAKE THE WATER BECAUSE WE ARE MORE IMPORTANT.

I THINK THEY OUGHT TO KNOW WHERE THE WATER IS COMING FROM BEFORE WE ALLOW THEM TO LEASE IT. (232) IN OTHER WORDS, I UNDERSTAND THAT THE PEOPLE IN NORTH DAKOTA TOLD THEM NO, THEY DIDN'T WANT TO SELL THEM WATER, AND THEY WERE GOING TO PIPE IT DOWN. I HAVE HEARD THINGS ABOUT THE MISSISSIPPI RIVER, BUT THAT'S ALL FINE AND GOOD.

I WOULD LIKE TO KNOW FOR SURE WHERE THEY ARE GOING TO GET IT. CERTAINLY WE DON'T HAVE ALL THE WATER THEY NEED FOR THE OIL SHALE PROCESS HERE ON THE WESTERN SLOPE. I DON'T THINK THAT IT'S, TO ME IT DOESN'T MAKE GOOD SENSE TO GIVE THEM THE LAND BEFORE THEY KNOW WHERE THE OTHER RESOURCES THAT THEY NEED ARE GOING TO COME FROM.

IN PAONIA, ARCO HAD TO GUARANTEE THE FARMERS THAT THE WATERSHED WOULD NOT BE SPOILED, BECAUSE THAT WOULD RUIN THEIR LIVELIHOOD. I WOULD LIKE TO SEE THE OIL COMPANIES DO SOMETHING OF THE SAME KIND OF DEAL THAT THEY STRUCK WITH ARCO IN PAONIA. (233)

THE LAST THING IS, IF WE DO THIS, I WOULD HOPE THAT OUR ROYALTIES WOULD BE AT LEAST AS MUCH AS COAL, IF NOT MORE. IT SEEMS LIKE THEY ARE WILLING TO (119)





PAY THE ARABS AN EXORBITANT PRICE PER BARREL OF OIL. I WOULD HOPE THEY FEEL THEIR FELLOW AMERICANS WOULD GET SOMEWHAT OF A GOOD SHAKE. IT WOULD HELP THE ECONOMY ON THE WESTERN SLOPE AND ALSO THEN, IT MIGHT OFFSET SOME OF THE THINGS THAT THEY WOULD TAKE AWAY FROM US, SUCH AS RECREATION AND GOOD AIR AND THAT KIND OF THING. THAT'S ALL I HAVE TO SAY.

CURT SMITH: THANK YOU, BARBARA. DOTTIE LAURITZEN?

DOTTIE LAURITZEN: I AM DOTTIE LAURITZEN WITH THE LEAGUE OF WOMEN VOTERS. I HAVE PREPARED A STATEMENT. THE LEAGUE OF WOMEN VOTERS OF THE GRAND JUNCTION AREA ENDORSES THE NO ACTION ALTERNATIVE TO THE PROPOSED ONE OR TWO PROTOTYPE OIL SHALE TRACTS SUGGESTED IN THE PICEANCE BASIN. THE PURPOSE OF THE PROTOTYPE LEASING WAS AND STILL IS TO DEVELOP TECHNOLOGY AND TEST THE ENVIRONMENTAL PERIMETERS SUCH AS AIR QUALITY, WATER AND SOIL.

PRIVATE OIL SHALE COMPANIES, SUCH AS UNION, MOBIL, AND CHEVRON ARE PRESENTLY DEVELOPING OR PLANNING TO DEVELOP THEIR OWN OPERATIONS. THUS THE IDEA OF WAITING FOR PROTOTYPE DATA WOULD SEEM TO BE OF LITTLE VALUE AS MILLIONS OF DOLLARS ARE BEING SPENT WEEKLY BY INDUSTRY, WITHOUT THE USE OF PROTOTYPE INFORMATION.

WHY WOULD A CONSIDERATION OF NEW PROTOTYPES

BE CONSIDERED WHEN EXISTING LEASES ARE NOT COMPLETED BUT, IN FACT, ARE ALL BUT CLOSED DOWN? TO ADD ADDITIONAL PROTOTYPE LEASING WOULD FURTHER IMPACT AREAS THAT HAVE NOT FULLY RECOVERED FROM EXXON. IT WOULD ALSO REQUIRE ADDITIONAL PLANNING FOR FUTURE PRIVATE DEVELOPMENT SUCH AS UNION, MOBIL AND CHEVRON, WHICH MAY NOT BE APPROPRIATE AT THIS TIME. (16)

OTHER ASPECTS OF SUCH A PLAN MUST ALSO BE ADDRESSED, SUCH AS THE SOCIO-ECONOMIC CONCERNS WHICH INVOLVE THE CUMULATIVE IMPACTS, BOTH DIRECT AND INDIRECT, ON OUR CITIES AND TOWNS.

WITH GROWTH, THE PROBLEMS OF STAFFING AND MAINTAINING LOCAL FIRE AND POLICE FORCES, PROVIDING SOCIAL SERVICES, ADMINISTERING JUSTICE, CONSTRUCTING ROADS, PROVIDING HOUSING, ESTABLISHING SCHOOLS AND CHURCHES, TO NAME BUT A FEW, ARE LEFT FOR THE LOCAL AGENCIES AND THE PEOPLE IN THESE COMMUNITIES TO DEAL WITH. QUESTIONS ON HOW TO FUND THESE EXPANDED SERVICES MIGHT SEVERELY TAX THE RESOURCES OF A SMALL TOWN OR A SPARSELY POPULATED COUNTY. (124)

IN MESA COUNTY, FOR INSTANCE, WHICH IS FEELING SECONDARY IMPACTS, NEW BONDS WERE VOTED TO HELP WITH THE NEED FOR SCHOOLS IN PROJECTED POPULATED AREAS. NEW TAXES HAVE BEEN IMPOSED ON COMMUNITIES TO PAY FOR ROADS AND RECREATIONAL AREAS THAT WILL BE NEEDED EVEN





MORE AS NEW GROWTH COMES IN FROM OIL SHALE PROJECTS.

THIS IS A GREAT CONCERN FOR ALL, BUT IS A ADDED BURDEN FOR THOSE PEOPLE WHO ARE ON FIXED INCOMES. BUT INDIVIDUALS ARE NOT THE ONLY GROUPS AFFECTED. LOCAL SMALL BUSINESSES MAKE LONG-RANGE INVESTMENTS IN BOTH EQUIPMENT AND MANPOWER, IN ANTICIPATION OF THE ACCELERATED GROWTH ASSOCIATED WITH OIL SHALE. THESE SAME SMALL BUSINESSES THAT DO SERVICES FOR THESE OIL SHALE RELATED COMPANIES AT TIMES HAVE TO WAIT SIX TO NINE MONTHS FOR THEIR MONEY AS THEY ARE PAID OUT OF HOME OFFICES.

THE LEAGUE OF WOMEN VOTERS OF THE GRAND JUNCTION AREA WOULD LIKE TO SEE SAFEGUARDS INCLUDED ALONG WITH MITIGATING MEASURES IN THE E.I.S. THAT WOULD INSURE SMALL BUSINESSES WOULD BE PROTECTED AGAINST BEING LEFT WITH INCREASED INVENTORY, MEN AND EQUIPMENT NEEDED FOR PROPOSED PROJECTS THAT COULD BE STOPPED OR DISCONTINUED BEFORE BEING COMPLETED, SUCH AS HAPPENED IN THE BOOM-BUST OF EXXON. (234)

OF ALL THE IMPACTS, THE SOCIO-ECONOMIC IMPACTS ARE OUR GREATEST CONCERN. OUR LAND USE AND ITS DEVELOPMENT, WHETHER IT BE FOR LEASING WILDERNESS AREAS, DEVELOPING TOWNS, FILLING AGRICULTURAL NEEDS, SHOULD BE DONE IN A TIMELY AND ORDERLY MANNER, TAKING INTO CONSIDERATION WATER AND AIR QUALITY, ECONOMIC

FACTORS, AND THE QUALITY OF LIFE IN AND AROUND THESE LANDS.

ANOTHER PROBLEM MUST BE FACED AS WE FURTHER DEVELOP OUR LANDS, WHETHER DIRECT OR SECONDARY. WE TAKE UP FARM LANDS, GRAZING LANDS, AND AGRICULTURAL LANDS. THE NEED FOR TOWNS AND NEW DEVELOPMENTS CAUSE BOUNDARIES TO EXPAND FOR THE TOWNS AND THE COMMUNITY, LEAVING THE FARMER AND FRUIT GROWER WITH INC[illegible] PRESSURE AS TO WHETHER TO SELL THE LAND FOR HOUSING AND FOR TRAILER TRACTS, OR [illegible] AREA. (235)

THE LEAGUE OF WOMEN VOTE OF THE GRAND JUNCTION AREA WOULD LIKE TO SUBMIT A FEW SUGGESTIONS FOR THE FINAL E.I.S. TO BE INCLUDED IN THE PROTOTYPE OIL SHALE LEASING PROGRAM. IT IS APPARENT THAT MUCH TIME AND HARD WORK AND SINCERE WRITING HAS GONE INTO THAT E.I.S. PROTOTYPE OIL SHALE PROGRAM PUBLICATION. HOWEVER, THE LEAGUE WOULD LIKE TO SEE STILL FURTHER IMPROVEMENTS MADE.

FIRST, MORE CLARIFICATION IS NEEDED IN MANY INSTANCES. FOR EXAMPLE, LOOK AT THE QUOTE ON PAGE 159, SECOND COLUMN, FIFTH PARAGRAPH. YOU CAN'T READ IT. (6)

IT IS NOT ALWAYS AN EASY DOCUMENT TO INTERPRET. IF SUCH AMBIGUOUS STATEMENTS COULD BE DELETED OR BE WRITTEN CLEARLY, IT WOULD HELP IN





EXPLAINING WHAT THE IMPACTS REALLY ARE.

THE LEAGUR IS ALSO CONCERNED AS TO HOW THIS PROTOTYPE E.I.S. QUANTIFIES THE REAL GROWTH, IMPACTS, AND QUALITY OF LIFE CHANGES. THIS DRAFT SPEAKS OF GROWTH IMPACTS BY NUMBERS AND SCENARIOS BOTH HIGH AND LOW ON POPULATION, BUT DOES NOT SPEAK TO THE REAL IMPACTS SUCH AS THE NEEDS FOR HOUSING, SCHOOLS, ROADS, SECONDARY WORKERS, POLICE, FIREMEN, ET CETERA. (130)

WHAT ABOUT THE NEED FOR WATER TREATMENT, SEWAGE DISPOSAL, HOSPITALS, AND SCHOOLS? HOW ARE THESE SERVICES TO BE FUNDED? ALSO HOW IS THE HUMAN ELEMENT TO BE TAKEN CARE OF, SUCH AS THE PROBLEM OF FIXED INCOME PEOPLE, DISPLACED PEOPLE, ENVIRONMENTAL QUALITY, RECREATIONAL AND EDUCATIONAL NEEDS? (124)

THE LEAGUE REALIZES THAT WITH ALL GROWTH THERE ARE PLUSES AS WELL AS MINUSES. THE LEAGUE IS SUPPORTIVE OF BLM AND COMMENDS THE EFFORTS IT IS MAKING TO SEE THAT THIS STATEMENT IS REVIEWED AND THAT THE PUBLIC IS GIVEN AN OPPORTUNITY FOR INPUT. THE LEAGUE IS NOT SAYING THAT THERE SHOULD BE NO GROWTH IN WESTERN COLORADO DUE TO OIL SHALE. IT IS SAYING GROWTH SHOULD BE PLANNED IN ASSOCIATION WITH VIABLE OIL SHALE PROJECTS, AND ANOTHER PROTOTYPE PROGRAM DOES NOT SEEM NECESSARY AT THIS TIME.

CURT SMITH: THANK YOU, DOTTIE. RUSS

ARENSMAN?

RUSS ARENSMAN: GOOD EVENING. MY NAME IS RUSS ARENSMAN. I AM THE WESTERN SLOPE ORGANIZER FOR A GROUP CALLED COLORADANS FOR RECYCLING. I AM ALSO A MEMBER OF THE WESTERN COLORADO CONGRESS.

THE MAIN REASON I AM HERE TONIGHT AND THE MAIN QUESTION I WOULD LIKE TO ASK IS, WHY MORE LEASES? (16) AT THIS POINT WE HAVE SEEN TWO LEASES THAT HAVE ALREADY BEEN GRANTED. WE HAVE SEEN VERY LIMITED SUCCESS IN THE OPERATIONS AT EITHER OF THOSE PLACES. YET DURING THE COURSE OF THE DEVELOPMENT THAT HAS TAKEN PLACE AT EACH OF THOSE LEASES, WE HAVE SEEN EXTENSIVE IMPACTS ON THE AREA OF THE PICEANCE BASIN AND THE AREA OF RIFLE, PARACHUTE, GRAND JUNCTION.

MY QUESTION IS, WE ALREADY HAVE SEVERAL. THEY ARE APPARENTLY NOT WORKING OUT VERY WELL. WE HAVE THE ENTIRE PICEANCE BASIN CRISS-CROSSED AND DOTTED WITH PRIVATE LEASE HOLDINGS, OR PRIVATE LAND HOLDINGS BY ENERGY COMPANIES. AT THIS POINT, THE ONLY COMPANY DOING ANY KIND OF SERIOUS DEVELOPMENT IS UNION OIL SHALE. THEIR PROJECT HAS BEEN ON GOING FOR SEVERAL YEARS.

WHY, I WANT TO KNOW -- IT JUST DOESN'T MAKE SENSE TO ME AT THIS PARTICULAR POINT IN TIME WHY WE NEED TO MAKE MORE LEASES AVAILABLE. IT SORT OF REMINDS





ME OF SAY AN AUTOMOBILE MANUFACTURER WHO UPON FINDING OUT THE PEOPLE ARE NOT BUYING HIS CARS, TURNS AROUND AND MAKES TWICE AS MANY MORE CARS JUST TO SEE IF SOMEBODY BY CHANCE WILL BUY THE SECOND ONES. IT JUST DOESN'T MAKE SENSE.

WHAT I WOULD LIKE TO SEE INCLUDED IN THIS ENVIRONMENTAL IMPACT STATEMENT THAT IS BEING PREPARED IS SOMETHING THAT ADDRESSES THE ENERGY ALTERNATIVES THAT WE HAVE HERE. (8) THE ORGANIZATION I AM WORKING FOR AT THIS POINT IS PROMOTING A BILL THAT WOULD REQUIRE BOTTLES AND CANS TO BE RECYCLED IN THIS STATE. A VERY SMALL MEASURE WOULD PUT A NICKEL DEPOSIT ON EACH BOTTLE AND CAN, YET STUDIES BY GOVERNOR LAMM'S OFFICE SHOW THAT ENOUGH ENERGY WOULD BE SAVED BY THIS ONE SIMPLE MEASURE TO HEAT THE HOMES OF 50,000 PEOPLE IN THE STATE OF COLORADO WITH THE ENERGY SAVED. THAT'S ONE SMALL THING.

WE HAVE SOLAR ENERGY DEVELOPMENT THAT IS BEING IGNORED AND SHUNTED ASIDE BY THE FEDERAL GOVERNMENT RIGHT NOW. I SIMPLY SEE NO REASON OR PURPOSE FOR THE TIMING OF GRANTING ADDITIONAL LEASES.

ANOTHER THING I WOULD LIKE TO SEE INCLUDED IN THIS IS A COST-BENEFIT ANALYSIS THAT IS GOING TO IN SOME WAY ADDRESS HOW MUCH THIS IS GOING TO COST US, THE TAXPAYERS, AND WHAT WE ARE GOING TO GET OUT OF IT. (167)

G
22

BASICALLY I AM AGAINST GRANTING ANY MORE LEASES. HOWEVER, I FEEL IF MORE LEASES MUST BE GRANTED, IF JAMES WATT FEELS SO MOVED THAT HE WOULD IGNORE MASSIVE PUBLIC SENTIMENT AGAINST GRANTING MORE LEASES, THEN SEVERAL THINGS SHOULD BE ADDRESSED. FIRST OF ALL, THE SOCIO-ECONOMICS OF THIS WHOLE PROPOSAL.

FOR THE LAST YEAR BEFORE MOVING TO GRAND JUNCTION, I WAS A RESIDENT OF RIFLE, COLORADO. I CAN TELL YOU LAST SUMMER DURING THE HEIGHT OF WHEN C-A AND C-B WERE STILL IN OPERATION, YOU COULD HARDLY GET ACROSS RAILROAD AVENUE. THERE ARE INADEQUATE PUBLIC FACILITIES IN TERMS OF STREETS, WATER, POLICE, SEWER, FIRE, AND AMBULANCE IN THE WHOLE REGION. AS FAR AS I CAN SEE, ONLY A MAKESHIFT ATTEMPT AT TRYING TO PROVIDE THOSE SERVICES IN THE AMOUNTS THAT WOULD BE REQUIRED TO ACCOMMODATE THE MASSIVE INFLUX OF PEOPLE THAT WOULD BE, SHOULD OIL SHALE DEVELOPMENT REALLY KICK OFF AND GETTING, THAT WOULD BE REQUIRED. (130)

FURTHERMORE, WILDLIFE, WE HAVE THE LARGEST HERD OF MULE DEER IN THE WORLD UP IN THE PICEANCE BASIN. WE HAVE SEEN THEIR POPULATION DECREASE DRASTICALLY YEAR AFTER YEAR NOW. WHAT IS THIS GOING TO DO TO MAKE THAT ANY BETTER? (15)

FINALLY, I WOULD LIKE TO SEE PROVISIONS INCLUDED IN THIS, IF MORE LEASES ARE GRANTED, THAT



G
23

WOULD PREVENT AGAINST CONTAMINATION OF THE WATER THAT IS IN THE AREA, AND ALSO PROTECT THE RIGHTS OF USAGE THAT ARE ALREADY EXISTING FOR THE PEOPLE IN THE AREA. (236) THE SAME THING FOR THE AIR QUALITY. I DON'T WANT TO SEE WESTERN COLORADO, THE PLACE THAT IS MY HOME, USED AS A TESTING GROUND FOR OIL SHALE DEVELOPMENT WITHOUT SOME KIND OF PROVISIONS TO PROTECT THE EXISTING PEOPLE AND THE ENVIRONMENT THAT ARE HERE RIGHT NOW. (28)

CURT SMITH: THANK YOU, RUSS. KATE HOLMES?

KATE HOLMES: MY NAME IS KATE HOLMES. I AM A RESIDENT OF FRUITA. I AM ALSO A MEMBER OF THE TWO RIVERS CITIZENS ASSOCIATION.

MY PRIMARY CONCERN TONIGHT IS THE PRESERVATION OF CLEAN AIR IN WESTERN COLORADO, AND THE CUMULATIVE ADVERSE EFFECTS THE PROPOSED FEDERAL OIL SHALE LEASES COULD HAVE WHEN ADDED TO THE MARGINAL AIR QUALITY ALREADY DOCUMENTED AND ATTRIBUTED TO EXISTING AND PREDICTED NEARBY OIL SHALE DEVELOPMENT.

I MOST STRONGLY SUPPORT THE NO ACTION ALTERNATIVE IN THE E.I.S., BUT AT LEAST WOULD URGE A DELAY IN THE PROPOSAL FOR ADDITIONAL LEASES UNTIL THE RESOURCE MANAGEMENT PLAN IS IN PLACE, AND MORE THOROUGH INVESTIGATION OF ENVIRONMENTAL IMPACTS HAS BEEN DONE. (174)

THE E.I.S. IN ITS IMPACT ANALYSES REPEATEDLY

POINTS OUT THAT NEW OIL SHALE DEVELOPMENT WOULD POSE SIGNIFICANT THREATS TO THE PRESERVATION OF FEDERAL AND STATE AIR QUALITY STANDARDS, BOTH IN NEARBY COMMUNITIES LIKE RIFLE AND MEEKER AND ALSO IN TWO ENVIRONMENTALLY SENSITIVE, WILDERNESS AREAS, MT. ZIRKEL AND THE FLAT TOPS.

THERE ARE AIR QUALITY PROBLEMS DESCRIBED IN ALL THREE PROPOSED ALTERNATIVES. IN THE NO ACTION ALTERNATIVE, IT IS PREDICTED THAT THE PRIVATE OIL SHALE DEVELOPMENT ALONE WHICH IS PLANNED FOR THE AREA WEST OF RIFLE WOULD PROBABLY CREATE SIGNIFICANT VIOLATIONS FOR TOTAL SUSPENDED PARTICULATES, SULPHUR DIOXIDES AND NITROGEN OXIDES. THERE WOULD BE ASSOCIATED VIOLATIONS IN THE MT. ZIRKEL AND BOOKCLIFFS AREA. IF PRIVATE DEVELOPMENT WILL PUSH THE AREA INTO THE DANGER ZONE FOR AIR QUALITY, WHY SHOULD THE GOVERNMENT PROCEED WITH PROJECTS WHICH WOULD ONLY AGGRAVATE THE SITUATION? (1)

TAKING THE C-11 AND/OR C-18 ALTERNATIVES, THE SAME PROBLEMS DISCUSSED ABOVE PREVAIL, ONLY TO A GREATER EXTENT. BUT IN ADDITION, POLLUTANTS WOULD REACH THE FLAT TOPS WILDERNESS AREA WHICH, LIKE MT. ZIRKEL, CARRIES THE EPA CLASS ONE DESIGNATION, MEANING THAT ANY DETERIORATION IS SEEN AS SIGNIFICANT. THE IMPACT IN THE FLAT TOPS WOULD BE LARGELY IN THE FORM OF LAKE CONTAMINATION CAUSED BY ACID RAIN WHICH IS





PRODUCED IN PART BY COMBUSTION PRODUCTS OF OIL SHALE RETORTING.

ACID RAIN HAS ALREADY BEEN DOCUMENTED IN THIS AREA BY THE ROCKY MOUNTAIN BIOLOGICAL LAB, AND THUS IS AN EXISTING PROBLEM. WITH LAKE CONTAMINATION COME THREATS TO THE FISH LIFE, THE LIFE OF THE LAKES THEMSELVES AND FINALLY THE TOURIST ATTRACTION VALUE OF THE AREA.

NOW TO A MORE IMMEDIATE CONCERN, THE AIR QUALITY OF THE GRAND VALLEY. EVEN THOUGH A BIT REMOVED FROM THE PROPOSED LEASES, OUR LIVES WOULD NOT GO UNAFFECTED. BECAUSE IT IS THE NEAREST LARGE URBANIZED AREA, GRAND JUNCTION AND THE GRAND VALLEY IN GENERAL WOULD MOST LIKELY BE THE COORDINATING CENTER FOR ANY SHALE INDUSTRY OF THE SIZE PREDICTED BY THE PROTOTYPE PROGRAM. WITH GROWTH OF THE INDUSTRY COME INCREASED POPULATION, INCREASED TRANSPORTATION ROUTES AND USE THEREOF, AND THE DEVELOPMENT OF SECONDARY INDUSTRIES AND PUBLIC SERVICES LIKE POWER PLANTS, ALL OF WHICH AFFECT AIR QUALITY. (143)

THE GRAND VALLEY IS ALREADY IN TROUBLE WITH ITS NON-ATTAINMENT AREA AIR QUALITY STATUS. WE VIOLATE THE FEDERAL STANDARDS FOR PARTICULATES. THOSE OF US LIVING HERE ARE ALL TOO AWARE OF THE EVIDENCE OF THE DETERIORATING AIR QUALITY. WE COUGH AND OUR EYES WATER

FROM EXHAUST FUMES AND THE DUST. OUR NOSES ARE INCREASINGLY ASSAULTED BY THE SMELLS FROM INDUSTRIAL AND VEHICULAR FUMES. FOR EXAMPLE, AS A RESIDENT OF FRUITA, I AM BLASTED ALMOST EVERY MORNING AND EVENING WITH THE HEAVY, NASTY SMELL OF HYDROCARBONS AND SULPHUR COMING FROM THE LOCAL REFINERY.

ALL OF THESE PROBLEMS WILL BE COMPOUNDED WITH DEVELOPMENT IF PLANNING AND SURVEILLANCE ARE NOT PRUDENT. TWO LARGE PROJECTS WHICH STAND TO GREATLY EFFECT THE AREA'S AIR QUALITY ARE ALREADY PROPOSED: THE COLORADO-UTE COAL-FIRED PLANT IN MACK AND THE CHEVRON REFINERY IN FRUITA, WHICH WILL BE EIGHT TIMES THE SIZE OF GARY REFINING

THE E.I.S. ACKNOWLEDGES THE UNAVOIDABLE IMPACTS THAT THE PROTYPE LEASES AND SECONDARY SOURCES WOULD HAVE. HOWEVER, THE BLM REASONS THAT SINCE ALL OF THE VIOLATIONS WILL OCCUR ANYWAY, DUE TO PRIVATE SOURCES ALONE AND SINCE THE PROTOTYPE LEASES WOULD OPERATE WELL WITHIN STANDARDS AND WOULD NOT CONTRIBUTE TO THE VIOLATIONS, THAT THEIR EMISSIONS WOULD NOT CONTRIBUTE TO THE DETERIORATION OF THE GENERAL AIR POOL IN WESTERN COLORADO. BLM'S REASONING WOULD HAVE US BELIEVE TO THE THAT THE AIR POLLUTION GENERATED ON THE PROTOTYPE SITES WOULD STAY RIGHT THERE AND WOULD NOT TRAVEL AND THUS ADD TO THE CONCENTRATIONS IN (25)





SURROUNDING AREAS. EVEN IF THEIR PROJECTS ARE KEPT INDIVIDUALLY WITHIN STANDARDS, THEY WILL CERTAINLY ADD TO THE GENERAL POLLUTION.

DEVELOPMENT AND GROWTH ARE INEVITABLE, I KNOW. I JUST REPEAT MY APPEAL FOR PRUDENT PLANNING AND IN THE CASE OF THE PROTOTYPE LEASING, IT WOULD SEEM TO BE MORE LOGICAL TO WAIT UNTIL THE RESOURCE MANAGEMENT PLAN FOR THE AREA IS DONE, BY WHICH TIME MORE MAY BE KNOWN ABOUT THE TYPES AND SEVERITY OF IMPACTS FROM PRIVATE OIL SHALE DEVELOPMENT AND SECONDARY SOURCES.

WE MUST NOT FORGET THAT OUR CLEAN AIR IS A FRAGILE AND VULNERABLE THING. IT IS IN SOME WAYS A NON-RENEWABLE RESOURCE. LEST WE THINK THAT THE AIR POLLUTION ASOCIATED WITH THE OIL SHALE INDUSTRY WOULD END WITH THE CLOSING OF THE MINES, CONSIDER THE FACT, AS THE E.I.S. DOES, THAT THERE WOULD BE PERMANENT DAMAGE INCURRED IN THE AREA BECAUSE OF THE REGIONAL DEVELOPMENT WHICH WOULD HAVE TAKEN PLACE, NOT TO MENTION THE UNKNOWN CUMULATIVE IMPACTS TO VEGETABLE, ANIMAL AND HUMAN HEALTH.

CURT SMITH: THANK YOU, KATE. JIM MORRIS?

JIM MORRIS: I DON'T WANT TO COMMENT TONIGHT, THANK YOU.

CURT SMITH: LOUISE NOYES?

LOUISE NOYES: I WOULD LIKE TO THAT YOU FOR THIS OPPORTUNITY TO SPEAK. I AM REPRESENTING THE ASPEN WILDERNESS WORKSHOP TONIGHT. THAT GROUP IS ALSO A MEMBER OF THE WESTERN COLORADO CONGRESS. I WAS GOING TO ADDRESS A LOT OF THE AIR QUALITY ISSUES ALSO. SINCE IT WAS JUST DONE SO ADMIRABLY, I WON'T DO THAT.

I WOULD LIKE TO SAY THAT THE DRAFT E.I.S. APPEARS TO BE A VERY SOLID DOCUMENT. YOU SHOULD BE CONGRATULATED FOR THAT. THE SCOPE COULD HAVE BEEN A LITTLE MORE BROAD AND WE WOULD HAVE THOUGHT YOU WOULD BETTER ADDRESS THE SERIOUS CONFUSION OF DOING THE DRAFT E.I.S. AND THE FINAL E.I.S. BEFORE A RESOURCE MANAGEMENT PLAN IS IN EFFECT. (174) I WILL SKIP OVER MOST OF WHAT I WAS GOING TO SAY BECAUSE IT WOULD BE JUST DUPLICATION.

ONE OTHER SERIOUS FLAW I WANTED TO BRING UP ABOUT THE LEASING SCENARIO IS THE FACT THAT ONLY 20 PERCENT OF THE RESOURCE WILL BE RECOVERED USING THE CURRENTLY AVAILABLE TECHNOLOGIES. THIS SEEMS LIKE A TERRIBLE WASTE OF NATIONAL ASSETS.

IT'S A TWO-SIDED WASTE. IT'S A WASTE OF THE MINERAL ASSETS AND THE INTANGIBLE ASSETS LIKE CLEAN AIR, CLEAN WATER AND THE UNDEVELOPED RANGELANDS. IT IS ILLOGICAL AND SENSELESS TO GO AHEAD WITH THE LEASING UNTIL IT IS POSSIBLE TO RECOVER MORE OF THE OIL FROM





THE ROCK. I LIKEN IT TO A SITUATION WHERE THE FAMILY GETS A THOUSAND DOLLARS IN WELFARE FROM THE GOVERNMENT AND LOSES EIGHT HUNDRED DOLLARS OF IT AT THE TRACK AND THERE'S A BIG FLAP ABOUT THAT. THAT'S BASICALLY WHAT YOU ARE TALKING ABOUT HERE.

ANOTHER SERIOUS FLAW IS THAT IT IS NOW TOO LATE FOR THE PROTOTYPE PROGRAM. AGAIN THE LADY FROM GRAND JUNCTION WENT INTO THAT, SO I WON'T. IN THE DRAFT E.I.S., IT IS ADMITTED THAT THERE ARE SYNERGISTIC POSSIBILITIES WITH RESPECT TO THE AIR QUALITY VALUES TO BE IMPACTED, AND THE EXACT IMPACTS WOULD BE UNKNOWN. THIS REINFORCES THE NECESSITY OF PROCEEDING CAUTIOUSLY WITH ANY MORE FEDERAL LEASING PROGRAMS, BECAUSE VISIBILITY DEGRADATION IS CAUSED BY THE SMALLEST AIRBORNE PARTICLES, PARTICULARLY THE NITROUS OXIDES. THAT WILL ALSO PROTECT HUMAN HEALTH AND WELFARE.

WE FEEL IT MAKES IT ALL THE MORE IMPORTANT TO RECOGNIZE THE NECESSITY OF MAINTAINING OUR DIVERSIFIED ECONOMY OF WESTERN COLORADO. THE AVERAGE SUMMER VISITOR SPENDS APPROXIMATELY $50 A DAY, WHILE THE AVERAGE WINTER VISITOR WILL SPEND AS MUCH AS $150 A DAY. OUR CLEAN AIR RESOURCE IS ONE THING THAT BRINGS MANY OF THESE TOURISTS TO OUR REGION AS OPPOSED TO SOME OTHER AREA.

THE ASPEN WILDERNESS WORKSHOP RECOMMENDS THE

NO LEASING ALTERNATIVE. WE WOULD GO ON RECORD AS HAVING THE LEAST OBJECTIONS TO LEASING ONLY TRACT C-18 IF THAT'S WHAT WOULD HAVE TO BE DONE, AND THAT'S ONLY AFTER THE R.M.P. IS COMPLETE. THIS SHOULD BE FOR MAXIMUM MULTIPLE MINERAL RECOVERY, AND THE LEASE SHOULD HAVE A PROVISION REQUIRING THAT, AS WELL AS ROYALTY REQUIREMENTS. (27)

SECTION EIGHT OF THE OIL SHALE LEASE ENVIRONMENTAL STIPULATIONS ADDRESSES THE AIR POLLUTION, AND IT SHOULD CONTAIN SPECIFIC LANGUAGE TO DEFINE THE COMPANIES' RESPONSIBILITIES AFTER SHUTDOWN, EVEN IF THAT SHUTDOWN IS PREMATURE, NOT JUST DURING CONSTRUCTION AND OPERATION AS THE WORDING IS NOW. (20)

AGAIN I THANK YOU FOR THIS OPPORTUNITY TO MAKE COMMENTS.

CURT SMITH: THANK YOU, LOUISE. JEANIE HEMPHILL?

JEANIE HEMPHILL: GOOD EVENING. MY NAME IS JEANIE HEMPHILL. AS A NEWCOMER TO NORTHWEST COLORADO BUT NOT A NEWCOMER TO COLORADO, I INITIALLY HESITATED TO COMMENT ON ANYTHING AS FORMIDABLE AS THE BUREAU OF LAND MANAGEMENT'S PROTOTYPE OIL SHALE LEASING ENVIRONMENTAL IMPACT STATEMENT. JUST THE NAME WAS OVERWHELMING. HOWEVER, THIS IS ALL THE MORE REASON THAT I, A LOW-INCOME CONCERNED COLORADO TAXPAYER AND





RESIDENT, OUGHT TO SPEAK OUT TONIGHT.

THE FUTURE OF OIL SHALE IN THE PICEANCE BASIN OF COLORADO WILL IN FACT AFFECT ME. IT ALREADY HAS AND IT WILL CONTINUE TO DO SO. HOWEVER, I WOULD LIKE TO SEE OIL SHALE'S IMPACT ON MY LIFE CAREFULLY CONTROLLED. I LIVE IN COLORADO BY CHOICE, NOT ACCIDENT, BECAUSE OF COLORADO'S WILD OPEN SPACES, CLEAN AIR AND WATER, BEAUTIFUL DESERT AND MOUNTAIN COUNTRY, SMALL TOWNS, ET CETERA. I HAVE BEEN IN COLORADO LONG ENOUGH TO SEE UPS AND DOWNS AND CHANGES IN QUALITY OF LIFE.

IN MY OPINION, AT THIS TIME MORE OIL SHALE LEASING WILL NOT IMPROVE MOST OF OUR LIVES. QUITE THE OPPOSITE. IN MY CASE, THE AREAS I HIKE FOR RECREATION STAND TO BE ERODED IN SIZE AND QUALITY. THE WILDLIFE I ENJOY WILL BE PRESSURED, AND THE BOOM CYCLE WILL BRING HOUSING AND FOOD COSTS WHICH I CAN NOT AFFORD. MORE TO THE POINT, HOWEVER, IS THE FACT THAT CURRENT OIL SHALE PROCESSES ARE INTENSELY ENERGY CONSUMPTIVE, RESULTING IN A QUESTIONABLE GAIN OF ENERGY. (10) IS IT EVEN POSSIBLE THAT WE TAKE SERIOUSLY SUCH AN INDUSTRY IN THIS DAY AND AGE OF ENERGY AWARENESS AND CONSERVATION? THIS IS NOT TO MENTION THE PRESENT ECONOMIC INFEASIBILITY OF OIL SHALE, THE PROBLEM OF INCOMPLETE MINERALS RECOVERY AND RECLAMATION DIFFICULTIES, ET CETERA. (16)

UNTIL BETTER TECHNOLOGY DEVELOPS AND ECONOMICS BECOME MORE FAVORABLE TO THE AVERAGE PERSON, I URGE NO FURTHER LEASING OF BLM LANDS FOR OIL SHALE AT THIS TIME. THANK YOU FOR THIS OPPORTUNITY TO COMMENT.

CURT SMITH: THANK YOU, JEANIE. BOB THOMASON?

BOB THOMASON: MY NAME IS BOB THOMASON. I REPRESENT CATHEDRAL BLUFFS OIL SHALE COMPANY, THE LESSEE OF TRACT C-B. I AM PLEASED TO SAY THAT CATHEDRAL BLUFFS SUPPORTS THE CONTINUED DEVELOPMENT OF SHALE OIL, OF THE SHALE OIL INDUSTRY AND ITS TECHNOLOGY. I AM ALSO PLEASED TO SAY THAT WE FEEL WE SHOULD PROCEED WITH DEVELOPING THE MECHANICS OF LEASING SO THAT THOSE MECHANICS CAN BE IN PLACE WHEN THE DEMAND FOR THE INDUSTRY REALLY STARTS TO ROLL FORWARD SO THAT IT MAY DO SO IN A TIMELY WAY.

I AM GOING TO SUBMIT COMMENTS IN WRITING AT A LATER DATE, BUT I WOULD LIKE TO SAY A COUPLE OF THINGS ABOUT THE BASIS FOR THOSE COMMENTS. FI[illegible] [illegible]E ARE CONCERNED ABOUT THE BASIS AND THE ASSUMPTIONS THAT GIVE RISE TO THE [illegible] [illegible]LITY SECTION OF THE DRAFT E.I.S. WE FEEL THAT THAT BASIS NEEDS TO BE MORE CLEARLY PROVIDED SO THAT WE CAN SEE THAT THE ASSUMPTIONS MIGHT BE REALLY DRAWN OUT OF PROPORTION HERE. (2) (79) (81)





I AM ALSO CONCERNED ABOUT THE BASIS AND ASSUMPTIONS THAT WERE MADE FOR THE HYDROLOGY PREDICTIONS. WE FEEL THAT THAT BASIS AND ASSUMPTION MAINLY COMES OUT OF OLD INFORMATION THAT HAS NOT BEEN VALIDATED, AND ALSO THAT THERE IS NO INFORMATION THAT SHOWS US THAT THE TWO AQUIFER SYSTEM IS FAR MORE COMPLEX THAN THAT, AND THAT THE IMPACTS WOULD BE MUCH REDUCED ON THE BASIS OF OUR CURRENT KNOWLEDGE, WHICH IS BASED ON DATA RATHER THAN EARLY PREDICTIONS AND ASSUMPTIONS MADE WITHOUT REAL DATA.

AS I MENTIONED, PREVIOUSLY, OUR COMMENTS WILL BE SENT TO YOU IN WRITING BEFORE THE END OF THE COMMENT PERIOD IS OVER WITH.

CURT SMITH: THANK YOU, BOB. DANIEL HALE.

DAN HALE: MY NAME IS DAN HALE. I AM GENERAL COUNSEL FOR OCCIDENTAL OIL SHALE. MY COMMENTS TONIGHT ARE GOING TO BE VERY BRIEF.

THE FIRST COMMENT IS, I WOULD LIKE TO SEE BOTH THE IS E.I.S. IMPACT STATEMENT AND THE RESOURCE MANAGEMENT PLAN TAKE INTO ACCOUNT IN ADDITION TO THE LEASES AND THE PRIVATE DEVELOPMENTS THAT THEY HAVE LOOKED AT ALSO, THE COLORADO LOWLAND SELECTIONS. THIS IS A VERY SERIOUS SELECTION BY THE STATE OF COLORADO IN ORDER THAT THEY MIGHT JOIN IN AND PARTICIPATE IN THE (123)

OIL SHALE DEVELOPMENT, AND IT SHOULD NOT BE SUMMARILY SHUNTED ASIDE, BASED UPON FEELINGS THAT THE BLM MIGHT HAVE REGARDING THE VALIDITY OF THAT SELECTION.

SECONDLY, I CAN'T HELP BUT FEEL THAT WE HAVE HEARD SOME EXTREMELY CONCERNED AND THOUGHTFUL COMMENTS TONIGHT. THEY ARE VERY APPROPRIATE. BUT I HOPE THAT YOU PAY VERY CAREFUL ATTENTION TO MR. THOMASON'S COMMENTS REGARDING THE FACTUAL BASIS THAT THOSE COMMENTS HAD, BASED ON THE DRAFT E.I.S.. WE THINK THERE'S A WHOLE LOT OF BETTER, NEWER AND MORE SCIENTIFIC DATA THAN WAS USED IN THAT E.I.S., WHICH HAS CAUSED PERHAPS AN UNDUE AMOUNT OF CONCERN. THANK YOU VERY MUCH.

CURT SMITH: THANK YOU, DAN. RAY GRONWALL?

RAY GRONWALL: I WILL RESPOND AT A LATER DATE IN WRITING.

CURT SMITH: JUDY MOFFATT?

JUDY MOFFATT: I AM JUDY MOFFAT, SPEAKING FOR THE GARFIELD-EAGLE COUNTY LEAGUE OF WOMEN VOTERS. ALONG WITH THE STATE LEAGUE OF WOMEN VOTERS, WE SUPPORT THE NO ACTION ALTERNATIVE. CONCERNS ABOUT SOCIO-ECONOMIC IMPACTS FOR RIFLE AND GARFIELD COUNTY ARE MAJOR REASON FOR OUR SUPPORTING THE NO ACTION ALTERNATIVE.





THE DRAFT E.I.S. SUMS IT UP VERY WELL. PARACHUTE, BATTLEMENT MESA, RIFLE, MEEKER AND POSSIBLY OTHER COMMUNITIES MAY BE HEAVILY IMPACTED BY OIL SHALE AND OTHER MINERAL DEVELOPMENTS ASSUMED IN THE NO ACTION ALTERNATIVE, DEPENDING ON THE COURSE OF EVENTS. IF THAT HAPPENS, EVEN MODERATE IMPACTS FROM THESE ALTERNATIVES, THE NEW LEASES, WOULD HAVE SERIOUS CONSEQUENCES WHEN COMMUNITY RESOURCES ARE ALREADY STRETCHED TO THEIR LIMITS.

THE DRAFT E.I.S. EXPLAINS THAT RIFLE IS EXPECTED TO GROW AT AN ANNUAL AVERAGE COMPOUNDED RATE OF ABOUT TEN PERCENT, EVEN WITHOUT ADDED PROTOTYPE LEASING. IT PROJECTS A LOW GROWTH RATE OF 19 PERCENT FOR ONE TRACT BY 1988, WITH A HIGH SCENARIO ESTIMATE OF 28 PERCENT; AND FOR BOTH TRACTS GROWTH COULD BE AS LOW AS 45 PERCENT OR AS HIGH AS 63 PERCENT. (124)

THE SUMMARY STATES THIS RANGE OF POPULATION INCREASE COULD CREATE VERY SEVERE SOCIAL STRUCTURAL BREAKDOWNS FOR THE COMMUNITY. THE GARFIELD-EAGLE COUNTY LEAGUE FEELS THIS GROWTH RATE WOULD BE UNACCEPTABLE AND WOULD CREATE INTOLERABLE AND UNNECESSARY STRESSES AND PROBLEMS FOR CURRENT RESIDENTS.

THE LEAGUE ALSO HAS SERIOUS CONCERNS ABOUT THE PROJECTED AIR QUALITY IMPACT. ACCORDING TO THE

DRAFT E.I.S., RIFLE CAN EXPECT AIR QUALITY VIOLATIONS FOR TSP, SULPHUR DIOXIDE AND NITROGEN OXIDES BY THE YEAR 2003, JUST FROM THE EXISTING OIL SHALE DEVELOPMENT ON PRIVATE LANDS. IT IS PREDICTED THAT NITROGEN OXIDES WILL BE 41 TIMES THE ANNUAL AVERAGE PRIMARY HEALTH STANDARD. THE E.I.S. CONCLUDES THAT THESE VIOLATIONS COULD POSE SIGNIFICANT HEALTH PROBLEMS FOR THE POPULATION OF RIFLE IF DEVELOPMENT OCCURS AS PREDICTED.

THE LEAGUE BELIEVES THERE MUST BE SOME AIR QUALITY ASSURANCES BUILT INTO ANY NEW LEASING PROCESS FROM THE START. (20) AFTER OBTAINING ITS LEASE, RIO BLANCO OIL SHALE HAS SOUGHT CHANGES IN THE MINERAL LEASING ACT TO ALLOW IT TO DISPOSE OFF TRACT. NO LEASES SHOULD BE GRANTED IF IT WILL IN FACT MEAN VIOLATIONS OF THE CURRENT NATIONAL AMBIENT AIR QUALITY STANDARDS AND THE P.S.D. INCREMENTS. WE SHOULD AVOID ANOTHER RIO BLANCO TYPE SITUATION WHERE AFTER A LEASE HAS BEEN GRANTED THE LEASE HOLDER CAN SAY, YOU GAVE ME MY LEASE, NOW YOU HAVE TO RELAX STANDARDS TO ALLOW ME TO USE IT. (1)

IF BLM DECIDE IT MUST LEASE, WE STRONGLY URGE THAT ONLY ONE TRACT BE LEASED. WE UNDERSTAND THE INTENT OF MORE LEASING WOULD BE TO TEST THE FEASIBILITY OF MULTIMINERAL EXTRACTION. THIS CAN BE ADEQUATELY TESTED ON ONE TRACT. LEASING TWO TRACTS, MUCH MORE THAN DOUBLES IMPACTS, ESPECIALLY SOCIO-ECONOMIC ONES.





THE GOALS OF THE ORIGINAL PROTOTYPE PROGRAM SHOULD GUIDE ANY NEW LEASES, BECAUSE NONE OF THE GOALS OF THE PROTOTYPE PROGRAM HAVE YET BEEN ACHIEVED, AND BECAUSE OF THE RECENT COLONY EXPERIENCE, WE RECOMMEND THAT PRODUCTION BE LIMITED TO TEN THOUSAND BARRELS A DAY. THIS WOULD ALLOW A COMPANY TO TEST THE ENVIRONMENTAL, ECONOMIC AND TECHNICAL FEASIBILITY OF ITS TECHNOLOGY, AND IT WOULD AFFORD SOME PROTECTION FOR THE AFFECTED COMMUNITIES AT THE SAME TIME. (16)

IF BLM SHOULD DECIDE IT MUST LEASE, WE PREFER TRACT C-18 OVER C-11. C-18 HAS SOMEWHAT LESS SEVERE IMPACTS IN SEVERAL CATEGORIES: WILDLIFE, ABILITY TO RECLAIM, LOCAL AIR QUALITY, ET CETERA. WE ALSO AGREE WITH THE STATE LEAGUE OF WOMEN VOTERS THAT PRESUMING A LEASE IS GRANTED, IT SHOULD BE STIPULATED THAT WHERE STATE ENVIRONMENTAL REGULATIONS ARE STRICTER THAN FEDERAL, THEN STATE STANDARDS MUST BE MET. (78) NEW FEDERAL LEGISLATION MAY NOT PROTECT COLORADO RESOURCES. IN ADDITION, THE STATE OF COLORADO SHOULD BE A PARTY TO DECISIONS ON ENVIRONMENTAL STIPULATIONS WHICH ARE LEFT TO THE DISCRETION OF A MINING SUPERVISOR. (114) FINALLY THE LEASE MUST REQUIRE THE RECOVERY OF NAHCOLITE AND DAWSONITE, OR LEASING BECOMES COMPLETELY SENSELESS. (27)

FOR THE MOST PART, WE FOUND THE E.I.S. TO BE

G
38

CLEARLY WORDED. IT WAS EASY TO FOLLOW FROM ONE SECTION TO ANOTHER, AND PROVIDED ESSENTIAL INFORMATION. ON PAGES 70 AND 171. HOWEVER, WE FELT THAT THE DISCUSSION OF ECONOMIC IMPACTS WAS INADEQUATE, ESPECIALLY FOR ANALYZING COST OF LIVING PROBLEMS ASSOCIATED GENERALLY WITH LOCAL INFLATION, BUT PARTICULARLY WITH HIGH COST OF HOUSING. THERE ARE A COUPLE OF SENTENCES DEALING WITH THESE PROBLEMS. (237)

ALSO WE QUESTION THE CONCLUSION THAT DEVELOPMENT OF OIL SHALE WOULD ADD TO GOVERNMENT REVENUES AT ALL LEVELS. THIS IS FOLLOWED UP BY WHAT APPEARED TO BE CONTRADICTORY STATEMENTS SUCH AS SINCE THE METHOD FOR DETERMINING ASSESSED VALUATION OF OIL SHALE HAS NOT BEEN DETERMINED, IT IS IMPOSSIBLE TO PROJECT THE IMPACT OF THE OPERATIONS ON PROPERTY TAXES.

ALSO THE SECTION CONCLUDES, FOR LEASING BOTH TRACTS, IT IS UNLIKELY THAT THE INCREASED REVENUES RECEIVED BY COMMUNITIES WOULD OFFSET THE CAPITAL AND OPERATING COSTS THAT WOULD BE NECESSITATED FOR SUCH RAPID POPULATION GROWTH, AND THE HEAVILY IMPACTED TOWNS WOULD NEED LARGE INFUSIONS OF ASSISTANCE. (238)

ALSO WE QUESTION THE ADEQUACY OF A DISCUSSION OF COMPETITION FOR LABOR UNDER SOCIO-ECONOMIC IMPACTS. AGAIN MORE MIGHT BE SAID. IT IS NOT JUST OTHER INDUSTRIES OR THE TRADE AND SERVICES



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39

SECTOR WHO ARE AFFECTED BY WORKERS LEAVING FOR HIGHER PAYING OIL SHALE JOBS. WE HAVE SEEN FROM EXPERIENCE THAT THE PUBLIC SERVICE SECTOR IS ENORMOUSLY AFFECTED BY A BRAIN DRAIN. TEACHERS, POLICE, CITY AND COUNTY PLANNING STAFF, ADMINISTRATORS, MEDIA PEOPLE -- ALL ARE AFFECTED. ALL SEGMENTS OF THE WORK FORCE ARE ATTRACTED BY SHALE'S HIGHER WAGES.

ANOTHER MINOR OBSERVATION IS THAT WE WONDERED IF IT MIGHT BE APPROPRIATE TO FACTOR IN THE AMOUNT OF RESOURCE THAT WILL BE LEFT UNRECOVERABLE AS PART OF THE NET ENERGY ANALYSIS. AS AN ASIDE, THE LOSS OF PERHAPS MORE THAN 75 PERCENT OF THE RESOURCE ALONE PERHAPS SHOULD INVALIDATE MORE LEASING. (239)

WE ALSO WISH THE CULTURAL RESOURCES STUDY AND THE PALEONTOLOGICAL STUDY MENTIONED AS SCHEDULED FOR COMPLETION FOR OCTOBER OF '82 HAD BEEN READY FOR INCLUSION IN THE DRAFT E.I.S.. WE UNDERSTAND THE TIME FRAME UNDER WHICH YOU ARE OPERATING.

IN SUMMARY, THE STATE LEAGUE OF WOMEN VOTERS HAS AN EIGHT-YEAR HISTORY OF SUPPORTING THE GOALS OF THE PROTOTYPE PROGRAM. THE GARFIELD-EAGLE COUNTY LEAGUE SEES NO SOUND REASON TO UNDERTAKE ADDED PROTOTYPE LEASING UNTIL THOSE GOALS HAVE BEEN ACHIEVED, ESPECIALLY IN THE CONTEXT OF THE PREDICTED SEVERE AIR QUALITY AND SOCIO-ECONOMIC IMPACTS FOR THE SURROUNDING

AREA.

THANK YOU FOR THE OPPORTUNITY TO SPEAK.

CURT SMITH: KEVIN MARKEY.

KEVIN MARKEY: MY NAME IS KEVIN MARKEY. I REPRESENT FRIENDS OF THE EARTH. TO START WITH, I WOULD LIKE TO AGREE WITH BOB THOMASON. MAYBE MORE EXPERIENCE IS NEEDED IN THE MECHANICS OF LEASING. MAYBE WE CAN LEASE C-A AND C-B OVER AGAIN, FIND A COMPANY THAT WILL DEVELOP THEM.

IN ANY CASE, MORE SERIOUSLY, FRIENDS OF THE EARTH WOULD HAVE LIKED TO SPEAK IN SUPPORT OF LEASING FOR THE PURPOSE OF TESTING MULTIMINERAL TECHNOLOGIES. HOWEVER, THERE IS NO STIPULATION IN THE LEASE WHICH WOULD ACTUALLY MAKE IT A MULTIMINERAL LEASE.

THERE ARE SEVERE OR VERY SEVERE SOCIO-ECONOMIC IMPACTS IN RIFLE AND MEEKER. THERE ARE NO ADEQUATE SOCIO-ECONOMIC MITIGATION MEASURES, LOW RESOURCE RECOVERY AND SEVERAL OTHER PROBLEMS. THEREFORE, UNTIL THESE PROBLEMS ARE RESOLVED, WE ENDORSE THE NO ACTION ALTERNATIVE.

THERE IS ONLY ONE ARGUMENT THAT FAVORS LEASING AT THIS TIME, AND THAT WOULD BE THE TESTING OF MULTIMINERAL TECHNOLOGIES. WE SPOKE TO THAT IN DENVER. UNTIL THERE IS A STIPULATION IN A LEASE, THERE IS NO REASON IN FACT TO GO FORWARD WITH THIS PROGRAM. THERE (27)





MIGHT BE ANOTHER REASON, FOR MANY PEOPLE ARE CONCERNED BY THE RECENT DOWNTURN IN THE ECONOMY ON THE WESTERN SLOPE. EVEN THOSE WHO HOPE THAT THIS NEW LEASE WILL SPUR INDUSTRY AND EMPLOYMENT MAY BE DISAPPOINTED.

MULTIMINERAL CORPORATION, THE ONLY FIRM SEEMINGLY INTERESTED AND WITH THE TECHNOLOGY WHICH SHOWS, MIGHT SHOW PROMISE, MAY IN FACT NOT BE THE DEVELOPER IF IT DOES SUCCESSFULLY BID. ITS PARENT COMPANY CHARTER IS IN SEVERE ECONOMIC STRAITS AND MAY NOT BE ABLE TO PROCEED WITH THE DEVELOPMENT OF THE LEASE. MOREOVER, ANY CAPITAL THAT IS DIVERTED FROM THE INDUSTRY FOR LAND ACQUISITION WILL END UP IN FACT HURTING THE DEVELOPMENT OF THE INDUSTRY.

SOCIO-ECONOMIC IMPACTS PREDICTED ARE SEVERE. HOWEVER, THE COMMITTED MITIGATION IS INADEQUATE TO MEET THE CHALLENGES POSED BY ONE OR TWO NEW LEASES. AS WE HAVE TALKED ABOUT BEFORE, BECAUSE OF THE POSSIBLE PRE-EMPTION BY FEDERAL LAW OF LOCAL GOVERNMENT AUTHORITIES, THE BLM HAS TO, MUST ENTER INTO THE SOCIO-ECONOMIC IMPACT MITIGATION IN A MORE ACTIVE WAY. (124) THE BONUSES MAY NOT BE ADEQUATE BECAUSE OF LOW CASH RESERVES OF MANY OF THE COMPANIES THAT WOULD BE INVOLVED, BECAUSE OF LOW READINESS OF THE TECHNOLOGY AND THINGS LIKE THAT. BUT MONEY IS NEVER ENOUGH. (133) COOPERATION, PLANNING, INFORMATION AND SPECIFIC

MITIGATION EFFORTS ARE NEEDED ALSO.

THUS WE PROPOSE TWO ADDITIONAL STIPULATIONS: ONE WOULD BE THE REQUIREMENT OF A MULTIPLE PARTY CONTRACT BETWEEN BLM, THE AFFECTED LOCAL GOVERNMENTS AND THE LESSEES, REQUIRED BY THE LEASE, WHICH WOULD PROVIDE FOR MITIGATION PLAN ACCEPTABLE TO ALL THE PARTIES AND ANY VIOLATION OF THAT MITIGATION PLAN WOULD BE A VIOLATION OF THE LEASE. (77)

SECOND OF ALL WOULD BE REQUIRED A STIPULATION REQUIRING PRE-PAYMENT OF ROYALTIES IF THE SECRETARY DETERMINED IN CONSULTATION WITH THE COMMUNITY AFFECTED THAT BONUSES AND LOCAL GOVERNMENT REVENUES OTHERWISE OBTAINED WOULD NOT BE SUFFICIENT TO MEET FRONT END COSTS. (133)

IN GENERAL, THE COMMITTED MITIGATION PROPOSED IN THE LEASE, WHICH IS BASICALLY THE LEASE ITSELF AND ITS STIPULATIONS, ARE INADEQUATE TO DEAL WITH THE PREDICTED IMPACTS. SOCIO-ECONOMIC IS THE (77) WORST EXAMPLE. AIR QUALITY ALSO. FOR EXAMPLE, THE THE E.I.S. SHOULD IDENTIFY AND ANALYZE ALTERNATIVE CONTROLS AND SITES. THERE SHOULD BE, THERE IS THE ADDITIONAL LEGAL BURDEN PLACED ON BLM AT THIS TIME AS DISCUSSED BY IN THE ENVIRONMENTAL DEFENSE FUNDS IN DENVER, TO LOOK AT ALTERNATIVE CONTROL TECHNOLOGIES AT THIS TIME. (138)

THERE ARE REMARKS ON PAGE TEN OF THE E.I.S. TAKING NOTE





THAT BECAUSE OF THE HIGH GROWTH, THE PROBLEMS WITH THE HIGH GROWTH SCENARIOS AND OTHER THINGS, THE DECISION MAKERS SHOULD CONSIDER ONLY THE INCREMENTAL GROWTH, AND TAKE INTO ACCOUNT OTHER ASSUMPTIONS CONCERNING, OR MORE RECENT ASSUMPTIONS CONCERNING THE GROWTH OF THE INDUSTRY. (2)

WE FEEL THAT THAT COMMENT SHOULD BE DELETED OR SIGNIFICANTLY REWRITTEN. EVEN WITH THE LOW SCENARIO, WHICH IS TRULY CONSERVATIVE AND ONE ADDITIONAL PROTOTYPE LEASE, THERE WOULD BE A SEVERE IMPACT. THE SITUATION ALSO COULD CHANGE. JUST ONE YEAR AGO WE WERE STILL TALKING ABOUT A VERY LARGE INDUSTRY AND THE EXXON SCENARIO WAS STILL BEING PUSHED AROUND AS A POSSIBILITY.

JUST AS THE PETROLEUM ECONOMY HAS RADICALLY CHANGED IN SIX MONTHS, SO CAN IT REVERSE JUST AS QUICKLY. FRIENDS OF THE EARTH HAS TENTATIVELY CONCLUDED IN A STUDY UNDER PREPARATION THAT LOWER INTEREST RATES -- WE ARE HEADED IN THAT DIRECTION -- HIGHER OIL PRICES AND SOME POSSIBLE LOAN GUARANTEES ARE ALL THAT IS NECESSARY TO SPUR THE INDUSTRY ONCE AGAIN. IF ANYTHING, YOU SHOULD BE WARNING THE DECISION MAKERS OF THE VOLATILITY OF THE DECISION AND WARN HIM THAT ISSUING A LEASE WILL ADD UNCERTAINTY, RAISE FALSE EXPECTATIONS AND CREATE ADDITIONAL COLONY'S C-A'S AND

C-B'S.

THERE ARE THREE WAYS TO PARTIALLY MITIGATE THE UNCERTAINTY AND THE IMPACTS CAUSED BY SPECULATION. ONE IS STRICT DILIGENCE REQUIREMENTS, THE LEASE THAT IS BEING PROPOSED IS REALLY NO DIFFERENT FROM THAT OFFERED IN 1974, YET THOSE DILIGENCE REQUIREMENTS HAVE BEEN TOO EASILY AVOIDED. ALSO THE OFFSETS ALLOWED IN THAT LEASE BASICALLY DELAY ANY TRUE DILIGENCE FOR A CONSIDERABLE AMOUNT OF TIME. (106)

THERE SHOULD ALSO BE A DEMONSTRATION OF READINESS AND MATURITY EITHER AT THE PRE-LEASING STEP OR AT THE DETAIL DEVELOPMENT PLAN STAGE, AND ALSO AN ADEQUATE BONUS MUST BE A TEST TO THE FINANCIAL READINESS OF THE LESSEE. THAT BONUS SHOULD BE AT LEAST EQUAL IN TERMS OF AMOUNTS RECOVERABLE IN COSTS OR DOLLARS PER RECOVERABLE BARREL TO THE AVERAGE OF THE 1974 LEASES, TIMES THE OIL PRICE INDEX AS DETERMINED UNDER THE 1974 LEASE. (186)

THE ROYALTIES ARE ALSO TOO LOW, HAS HAS BEEN MENTIONED ELSEWHERE. BLM SHOULD CORRECT ITS ERROR IN THE 1973 E.I.S. AND THE 1974 LEASES, WHICH ISSUED THE LEASES AT TWELVE CENTS PER TON. THAT WAS MADE ON THE BASIS OF A DETERMINATION THAT OIL PRICES WOULD BE ABOUT $3.00 PER BARREL, INSTEAD OF THE $7.00 PER BARREL THAT ACTUALLY OCCURRED WHEN THE LEASES WERE ISSUED IN 1974. (119)





IN TERMS OF LAND USE, EITHER C-11 OR C-18 MAY BE THE WRONG LOCATION. MOST TRACTS IN THE M.F.P. ARE PROBABLY INAPPROPRIATE FOR MULTIMINERAL DEVELOPMENT, AND ONLY ONE IS APPROPRIATE IN TERMS OF MINERAL RESOURCE VALUES, ALTHOUGH THERE IS PROBABLY LESS OIL SHALE NAHCOLITE AND DAWSONITE. THIS IS TRACT C-1.

WILDLIFE IMPACTS MAY BE MORE SEVERE THAN C-18. HOWEVER, LESS SEVERE THAN C-11, BUT THERE MAY BE FEWER IMPACTS IN TERMS OF SOCIO-ECONOMIC AND AIR QUALITY. ANY TRACT IN THE NORTH ALSO MAY BE MORE ACCESSIBLE AND THEREFORE LESS COSTLY TO DEVELOP, AT LEAST GEOLOGICALLY MORE ACCESSIBLE.

BLM'S RUSH TO LEASE THIS PROTOTYPE WILL POSSIBLY CREATE ANOTHER PROTOTYPE FAILURE, AND WE WOULD ENCOURAGE YOU TO LOOK AT THE POSSIBILITY OF POSTPONING ANY LEASING UNTIL THE R.M.P. HAS A CHANCE TO LOOK AT SOME ALTERNATIVE MULTIMINERAL TRACTS. (174)

FINALLY, THE ALTERNATIVE ENERGY IN THE E.I.S., YOU REFER TO THE ENERGY ALTERNATIVES VOLUME OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT ISSUED IN 1973 AS BEING ADEQUATE FOR AN ANALYSIS OF ENERGY ALTERNATIVES IN THIS YEAR. I WOULD POINT OUT THAT IT IS REALLY NOT ADEQUATE, PROJECTED ENERGY YIELDS ARE HIGHER, NEEDS ARE MUCH LOWER. IN FACT LOWER BY ABOUT (8)

20 QUADS PER YEAR NATIONALLY. SINCE 1973, THE INDUSTRY AND THE GOVERNMENT HAVE IN FACT DISCOVERED OIL PRICE ELASTICITY. ALSO SINCE 1973 THERE HAVE BEEN ADVANCES IN BIOMASS TECHNOLOGY, AND ALSO SINCE 1973 THE ROLL OF ENERGY CONSUMPTION IN DETERMINING THE GROSS NATIONAL PRODUCT HAS ALSO BEEN REPUDIATED.

WE WOULD HOPE YOU WOULD RE-EVALUATE THE ENERGY ALTERNATIVES THAT ARE AVAILABLE AND TO CONCLUDE, FINALLY, RECOMMEND NO ACTION OR POSTPONEMENT OF ANY DECISION ON LEASING UNTIL THE SUGGESTIONS THAT WE HAVE MADE HERE HAVE IN FACT BEEN INCORPORATED IN A LEASE OR UNTIL A MULTIMINERAL LEASE HAS BEEN EVALUATED AS PART OF THE R.M.P.

CURT SMITH: THANK YOU, KEVIN. TED NATION.

TED NATION: MY NAME IS TED NATION. I AM THE CURRENT PRESIDENT OF THE WESTERN COLORADO CONGRESS, AN ORGANIZATION OF CITIZENS GROUPS, CONSUMERS, AGRICULTURISTS AND WESTERN SLOPE CITIZENS.

MY TESTIMONY IS PRESENTED ON THE BEHALF OF THE WESTERN COLORADO CONGRESS. THE CONGRESS WISHES TO COMPLIMENT THE TEAM THAT PREPARED THIS DRAFT E.I.S. WHILE WE HAVE A NUMBER OF CRITICISMS WE WILL DETAIL, WE FOUND IT TO BE A GREAT IMPROVEMENT OVER SIMILAR DOCUMENTS WE HAVE REVIEWED IN THE PAST.





THE MOST SIGNIFICANT IMPROVEMENT WAS THE ATTEMPT TO CONSIDER THE PROPOSED [illegible] WITHIN THE CONTEXT OF THE ACTIVITIES NOW UNDERWAY OR PROPOSED. UNFORTUNATELY THIS ANAL[illegible] FEARS ABOUT THE CUMULATIVE IMPACTS OF THE EXISTING PROPOSALS. THE VIOLATION OF PRIMARY HEALTH STANDARDS FOR NITROUS OXIDES, T.S.P. LEVELS, AND SULPHUR DIOXIDES PREDICTED IN THE DOCUMENT ARE FRIGHTENING. SOCIO-ECONOMIC IMPACTS SUGGESTED ARE ONLY SLIGHTLY LESS SO.

EVEN THOUGH M.C.C. HAS IN THE PAST PUBLICLY STATED THAT ONE ADDITIONAL PROTOTYPE LEASE SUITABLE TO TEST THE MULTIMINERAL PROCESS MIGHT BE CALLED FOR, WE FEEL COMPELLED BY THE INFORMATION IN THIS DOCUMENT TO RECOMMEND THE NO ACTION ALTERNATIVE OR A POSTPONEMENT UNTIL OTHER ALTERNATIVE ACTIONS SUCH AS A RESEARCH TRACT CAN BE EVALUATED. IF LEASING IS APPROVED, WE CERTAINLY FEEL THAT ONLY ONE LEASE TRACT SHOULD BE LEASED. THIS WOULD CUT THE SUGGESTED IMPACTS BY ONE-HALF.

OF THE TWO TRACTS, C-18 IS THE BEST CHOICE. IT WOULD BE EASIER TO RECLAIM, HAS FEWER WILDLIFE IMPACTS, MIGHT HAVE LESS SOCIO-ECONOMIC IMPACT. HOWEVER, THE TERMS OF THE PROPOSED LEASE SHOULD BE CHANGED DRASTICALLY IF THIS IS THE CHOSEN ALTERNATIVE.

SINCE THE JOINT RECOVERY OF DAWSONITE AND NAHCOLITE WITH OIL SHALE IS THE ONLY POSSIBLE REASON FOR ANOTHER PROTOTYPE LEASE, THE LEASE SHOULD REQUIRE THE MAXIMUM ECONOMIC RECOVERY OF THESE TWO MINERALS. (27)

STRONG SOCIO-ECONOMIC STIPULATIONS SHOULD BE INCLUDED TO ENSURE THAT AFFECTED COMMUNITIES AND INDIVIDUALS RECEIVE ADEQUATE ASSISTANCE IN A TIME FRAME TO BE EFFECTIVE TO MITIGATE THE NEGATIVE CONSEQUENCES OF THE LEASE, BOTH AT THE FRONT END AND LATER DURING THE BUST, SHOULD ACTIVITY BEGIN AND ONCE AGAIN PROVE UNECONOMIC. SPECIFIC PROVISIONS SHOULD BE INCLUDED TO MITIGATE THE IMPACTS ON THE MOST VULNERABLE PORTIONS OF THE POPULATION, SUCH AS THE ELDERLY. HIGHER ROYALTY RATES AND DILIGENCE, AT LEAST EQUAL TO C-A AND C-B, SHOULD ALSO BE REQUIRED IN THE LEASE REQUIREMENTS. (124)

THE LEASE STIPULATIONS SHOULD REQUIRE THE LEASE HOLDER TO PAY A COST EQUIVALENT TO AT LEAST THE MARGINAL COST OF NEW ELECTRICITY FOR ANY POWER PURCHASED FROM THE PUBLIC GRIDS. IT SHOULD ALSO REQUIRE THAT ANY COGENERATED POWER FROM LOW B.T.U. GASES BE USED FIRST TO MEET THE TRACT'S POWER CONSUMPTION BEFORE BEING MADE AVAILABLE FOR SALE TO THE UTILITIES UNDER P2R86. THIS WOULD AVOID THE POSSIBILITY OF BUYING POWER AT RELATIVELY LOW INDUSTRIAL RATES AND SELLING COGENERATED POWER BACK AT (240)





A HIGHER PRICE REQUIRED BY P2R86. FOR A DETAILED DISCUSSION OF THIS POSSIBILITY, I REFER YOU TO THE STUDY PUBLISHED THIS PAST YEAR BY THE STATE ENERGY ADVOCACY OFFICE AND TO THE INDEX PUBLISHED WITH IT BY BRUCE COLE.

THE WESTERN COLORADO CONGRESS DOES HAVE A NUMBER OF DISAGREEMENTS WITH THE CONTENTS OF THIS DOCUMENT AND SUGGESTIONS FOR IMPROVEMENTS. I WILL TOUCH ON SOME OF THE THEM AND LEAVE THE FLESHING OUT TO OTHERS OR WRITTEN TESTIMONY.

YOUR STATEMENT ON PAGE 18 THAT THE 1973 PROTOTYPE E.I.S. EXAMINED OTHER ENERGY ALTERNATIVES TO THE PROTOTYPE PROGRAM AND THAT IT IS BELIEVED THAT THIS ANALYSIS IS STILL VALID IS TOTALLY INADEQUATE AND ABSURD. CERTAINLY, CONTRARY TO OIL SHALE, A NUMBER OF RENEWABLE SOURCES OF ENERGY HAVE MADE REMARKABLE TECHNOLOGICAL PROGRESS. THE WESTERN COLORADO CONGRESS RECENTLY SPONSORED A PRESS CONFERENCE WITH AMORY LOVINS AND PRACTITIONERS IN CONSERVATION AND SOLAR IN WESTERN COLORADO TO CALL ATTENTION TO THE IMPACT THIS ACTIVITY IS HAVING LOCALLY AND TO ITS POTENTIAL NATIONAL.

THERE HAVE BEEN DOZENS, PROBABLY HUNDREDS OF STUDIES AND REPORTS DONE SINCE 1973 DOCUMENTING THE COST EFFECTIVENESS OF THESE ENERGY ALTERNATIVES, PARTICULARLY IMPROVEMENTS IN EFFICIENCY. INDEED, THE (8)

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50

MARKET, AS IMPERFECT AS IT IS WITH THE MANY INSTITUTIONAL DIFFICULTIES, IS IMPROVING THIS ALTERNATIVE.

OIL PRODUCTION HAS SLIGHTLY DECLINED SINCE 1978, BUT IMPORTS HAVE BEEN REDUCED FROM ONE-HALF OF THE DOMESTIC CONSUMPTION TO LESS THAN ONE-THIRD. JUST THE IMPROVEMENT IN THE CAR FLEET FROM AN AVERAGE OF 12 MILES PER GALLON TO AN AVERAGE OF 15 MILES PER GALLON HAS SAVED MORE OIL PER YEAR THAN ANY RESPONSIBLY SIZED OIL SHALE INDUSTRY COULD EVER PRODUCE. THE POTENTIAL IN TURNING THE CAR FLEET OVER TO THE 30 TO 40 MILES PER GALLON COMMON IN SOME NEWER VEHICLES AND IMPORTS, OR TO THE 70 TO 80 MILES PER GALLON FIGURE BEING REACHED BY SOME TEST VEHICLES WOULD MORE THAN ELIMINATE OIL IMPORTS.

INDEED, THE PROGRESS BEING MADE IN AUTOS, AIRPLANES, INDUSTRY, HOUSING, AND ELSEWHERE, IS ONE OF THE MAJOR REASONS THAT SYNTHETIC FUELS REMAIN UNECONOMIC TODAY. AN ADEQUATE E.I.S. REQUIRES A MORE DETAILED ANALYSIS OF THESE IMPORTANT ENERGY SOURCES.

THE DISMISSAL OF THE TERTIARY EFFECTS INCLUDING POWER PLANTS IS EQUALLY NEGLIGENT. THIS IS PARTICULARLY TRUE SINCE THE LOCATION OF PLANTS IN THE OIL SHALE REGION SUCH AS THE BONANZA PLANTS AND THE COLORADO-UTE'S PROPOSED SOUTHWEST PROJECT WILL COMPETE (2)



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51

WITH OIL SHALE FACILITIES FOR AIR QUALITY INCREMENTS.

WE WOULD ALSO QUARREL WITH THE STATEMENT THAT YOU MADE UNDER YOUR NET ENERGY ANALYSIS THAT THE MAJOR ENERGY REQUIRED IS ELECTRICITY, WHICH HAS LESS UTILITY THAN OIL. ELECTRICITY IS THE PREMIUM FORM OF ENERGY AND SHOULD ONLY BE USED FOR PREMIUM USES. IT IS ALSO VERY ENVIRONMENTALLY DESTRUCTIVE TO PRODUCE EITHER IN AIR QUALITY IMPACTS WITH COAL-FIRED PLANTS OR THE MANY PROBLEMS ASSOCIATED WITH NUCLEAR FUEL CYCLE. A DETAILED ANALYSIS OF THE IMPACTS OF 21.9 TO 230.8 MEGAWATTS IN ADDITIONAL DEMANDPER LEASE UPON RATE-PAYERS AND THE ENVIRONMENT IS CLEARLY CALLED FOR IN THIS STATEMENT. (241)

WE ALSO FOUND IT DIFFICULT TO RELATE THE DATA YOU PRESENT ON COMMUNITY REVENUE TO ANY DATA ON COMMUNITY MITIGATION NEEDS. CLEARLY FROM PAST EXPERIENCE WHAT IS NEEDED IS SOMETHING THAT RELATES COMMUNITY INCOME TO COMMUNITY NEEDS IN A REAL TIME FRAME. FUNDS ARE MOST CRUCIAL IN THE FRONT END OF ANY PROJECT BEFORE ROYALTIES AND PROPERTY TAXES ARE AVAILABLE. AND AFTER ANY BUSTS WHEN EVEN THE ILLUSION OF FUTURE INCOME IS GONE AND COMMUNITIES ARE LEFT WITH DEBTS, UNEMPLOYED CITIZENS AND OVEREXTENDED BUSINESSES. THE FACT THAT THE LEASE TRACTS ARE IN RIO BLANCO COUNTY AND MANY OF THE MORE SERIOUS IMPACTS ARE IN GARFIELD (118)

COLORADO REPORTING SERVICE

COUNTY WOULD SEEM TO REQUIRE A DETAILED DISCUSSION OF THE JURISDICTIONAL MISMATCH AND HOPEFULLY SOME LEASE STIPULATIONS REQUIRING ADEQUATE MITIGATION IN GARFIELD COUNTY. STIPULATIONS REQUIRING THE LEASE HOLDER TO ACCEPT THE LAND USE POLICIES AND THE PERMITS AND REGULATIONS OF RIO BLANCO COUNTY REGARDLESS OF THE (78) DEVELOPMENT COUNTY'S DECISION WOULD BE ALSO HIGHLY DESIRABLE.

A DISCUSSION OF AGRICULTURE, ONLY IN SHORT-TERM ECONOMIC TERMS WHILE IGNORING THE FACT THAT IT IS A SUSTAINABLE LONG-TERM INDUSTRY WHOSE PRODUCT IS (2) LIKELY TO BE VITALLY IMPORTANT IN A DECADE OR TWO WAS ALSO OBJECTIONABLE. HOUSING, ON THE OTHER HAND, WAS DEALT WITH ON A NUMBER OF UNITS BASIS WITHOUT A DISCUSSION OF COSTS AND HOW VULNERABLE GROUPS WOULD (237) FAIR IN A TIGHT MARKET.

THE DISMISSAL OF ACID PRECIPITATION BY REFERRING TO THE FEDERAL FIVE-YEAR STUDY IS ALSO (7) UNACCEPTABLE. I THINK THERE ARE A NUMBER OF OTHER ITEMS HERE THAT ARE SOMEWHAT MINOR THAT WE WILL DETAIL IN OUR WRITTEN STATEMENT, BUT I WOULD LIKE TO CLOSE BY REITERATING THAT WE FAVOR THE NO ACTION ALTERNATIVE. IF THAT'S UNACCEPTABLE, AT LEAST A DELAY IN THE PROGRAM UNTIL THE R.M.P. IS COMPLETE AND UNTIL SOME OTHER POSSIBILITIES LIKE A RESEARCH TRACT CAN BE CONSIDERED.





CURT SMITH: THANK YOU. TED WAS THE LAST OF THE INDIVIDUALS SIGNED UP TO MAKE A STATEMENT. ARE THERE ANY OTHERS IN THE AUDIENCE NOW THAT WOULD LIKE TO COME FORWARD AND MAKE A STATEMENT AT THIS TIME? YES.

JOHN WILKENSON: I JUST REPRESENT MYSELF, A CONCERNED CITIZEN HERE. FIRST OF ALL, I SUPPORT THE NO ACTION ALTERNATIVE. I THINK I'VE GOT SOME PRETTY GOOD REASONS. MY INTERESTS ARE COMMERCIAL REFRIGERATION, HEAT AND SOLAR ALTERNATIVE RENEWABLE SOURCES OF ENERGY, THINGS LIKE THAT. THE SITUATION TO ME SEEMS SIMILAR TO A GROUP OF EXECUTIVES WHO BOUGHT A BUILDING WHICH THE MECHANICAL SYSTEM DOESN'T WORK, SO THEY SPEND MORE MONEY ON STUDIES ABOUT WHAT TO DO ABOUT THE PROBLEM THAN IT WOULD COST TO INSTALL A RELIABLE SYSTEM. AFTER SPENDING ALL THIS MONEY ON THE STUDIES, THEY GO AHEAD AND GIVE A BLANK CHECK TO THE OUTFIT THAT INSTALLED THE ORIGINAL SYSTEM THAT WON'T WORK.

I THINK RESEARCH OF OIL SHALE IS GOOD. APPARENTLY THAT'S ALREADY BEING DONE ON A FAIRLY LARGE SCALE. TO LEASE THIS LAND BEFORE THERE IS ANY SOLID CONCRETE PLAN ABOUT WHAT IS GOING TO HAPPEN TO THE WESTERN SLOPE, TO ME THAT SEEMS EXACTLY LIKE, AS I SAID, GIVING A BLANK CHECK. THAT DOESN'T QUITE SET RIGHT WITH ME. I WOULD PREFER TO KNOW MORE ABOUT WHAT

EXACTLY IS GOING TO HAPPEN.

I PERSONALLY AM CONCERNED BY THIS ADMINISTRATION'S APPARENT GENERAL PHILOSOPHY REGARDING CENTRALIZATION VERSUS DECENTRALIZATION AND CONSERVATION. IT IS NOT AS IF SOLAR WERE A FUTURISTIC THING OR ALCOHOL WERE A FUTURISTIC THING OR THESE RENEWABLE RESOURCES ARE NOT A FACT AND THE TECHNOLOGY IS NOT HERE TO UTILIZE THEM TO THE MAXIMUM.

IT'S KIND OF LIKE POLITICS, WHO IS GOING TO GET WHAT OUT OF WHAT HAPPENS. I AM TROUBLED BY THAT. IT SEEMS TO ME OUR FIRST INTEREST SHOULD BE TO UTILIZE TO THE MAXIMUM SOLAR ENERGY, ALCOHOL. IT WOULD BE A GREAT BOOST TO THE WHOLE ECONOMY AND THE AGRICULTURAL INDUSTRY IN GENERAL. (8)

A LOT OF PEOPLE HAVE EXPRESSSED CONCERN ABOUT WHAT IS GOING TO HAPPEN TO THE WATER. THE STREAMS GO INTO THE RIVER. WE ALL KNOW THAT CALIFORNIA TURNED DOWN THE PERIPHERAL CANAL, WHICH I SORT OF ALWAYS SUSPECTED THE REASON FOR THAT WAS, IF SOUTHERN CALIFORNIA COULD USE NORTHERN CALIFORNIA'S WATER, THEN WE COULD USE THE COLORADO RIVER TO DEVELOP OIL SHALE. THAT DIDN'T WORK OUT.

WHERE ARE WE GOING TO GET THIS WATER FROM? WHAT IS REALLY GOING TO BE THE IMPACT ON OUR AGRICULTURE? AGRICULTURE HAS BEEN OUR STAND-BY (232)





INDUSTRY. IT'S BEEN HERE EVER SINCE THE VALLEY HAS BEEN HERE. I DON'T THINK WE OUGHT TO JUST GO INTO SOMETHING AS IMPORTANT AS THE DEVELOPMENT OF OIL SHALE PELL-MELL.

I WOULD LIKE TO SEE SOME STUDIES DONE ON HOW THE INFLUX OF PEOPLE THAT WOULD COME INTO THIS AREA WOULD AFFECT THE DEVELOPMENT OF AGRICULTURAL LAND INTO RESIDENTIAL LAND. (242) WE ALL KNOW WHAT HAPPENED WITH EXXON. WHAT HAPPENED WITH EXXON? YOU COME IN HERE, CREATE A WHEELER-DEALER TYPE ATMOSPHERE IN WHICH, MILLIONS OF DOLLARS OF THE TAXPAYERS' MONEY ARE SPENT BUILDING SCHOOLS IN THE MIDDLE OF NOWHERE, PRESUMING THERE WILL BE CHILDREN TO FILL THOSE SCHOOLS, AND THIS TIME IT JUST DIDN'T HAPPEN.

I THINK THAT IN MY OPINION, WE ARE AT A CROSSROADS OF A HUGE CHOICE, NOT JUST THE WESTERN SLOPE BUT THE ENTIRE COUNTRY, OF HOW WE ARE GOING TO APPROACH THE FUTURE AND THE QUALITY OF LIFE, THE WHOLE THING, ENERGY. AND I DO NOT WANT TO SEE, ESPECIALLY AT A TIME WHEN WE ARE IN THE MIDDLE OF A CRITICAL MONETARY CRISIS THAT NOBODY SEEMS TO BE AWARE OF BECAUSE IT IS NOT BEING TRUMPETED VERY MUCH. I WOULD REALLY HATE TO SEE MR. WATT AND THE BANKING ENERGY CARTEL SHOVE US INTO A DECISION WE MIGHT REALLY BE SORRY FOR LATER.

I WOULD LIKE TO SEE -- THERE ARE PEOPLE THAT

KNOW ALL ABOUT THIS. IF YOU DON'T KNOW THEM, I WILL BE GLAD TO INTRODUCE YOU TO THEM. THE TECHNICAL KNOWLEDGE FOR THESE THINGS IS HERE NOW. I THINK WE REALLY OUGHT TO INVESTIGATE IT FIRST BEFORE WE JUST GIVE THESE PEOPLE A BLANK CHECK. I AM NOT AGAINST -- IF IT HAS TO HAPPEN EVENTUALLY, IT HAS TO HAPPEN, BUT NOT JUST A BLANK CHECK NOW.

CURT SMITH: THANK YOU, JOHN. ARE THERE ANY OTHERS WHO WOULD LIKE TO MAKE A STATEMENT AT THIS TIME? YES?

BRAD KLAFEHN: MY NAME IS BRAD KLAFEHN. I AM WORKING AS A LIBRARIAN UP IN CRAWFORD, COLORADO. I AM HAPPY TO SERVE ON THE EXECUTIVE COMMITTEE OF THE WESTERN COLORADO CONGRESS.

I HAVE JUST GOT A COUPLE OF COMMENTS ON WHAT POLITICIANS LOVE TO CALL THE LIFEBLOOD OF THE WEST, MEANING WATER. ONE STATEMENT IN THE DRAFT E.I.S. SAYS THAT AS A RESULT OF DEVELOPMENT OF THE TRACTS THAT THESE TRIBUTARY LOADS TO THE WHITE RIVER MIGHT BE REDUCED BY THREE THOUSAND TONS PER YEAR. I ASSUME THAT THAT'S BECAUSE NOT AS MUCH SALT LADEN WATER IS GOING INTO THE WHITE RIVER FROM THE PICEANCE BASIN.

I WOULD LIKE TO REFER YOU TO A 1979 REPORT DONE BY COLTER AND ASSOCIATES FOR THE U.S.BUREAU OF MINES, WHICH SAID THAT THE IN SITU DEVELOPMENT OF THE (253)





TWO PROTOTYPE LEASES NOW IN COLORADO COULD ADD UP TO 500 TONS OF SALT PER DAY TO THE COLORADO RIVER FOR OVER A HUNDRED YEARS. THAT STUDY, I THINK, SHOULD GO INTO YOUR ANALYSIS.

I ALSO THINK THAT THE IMPACT STATEMENT SHOULD, IF IT CAN, TRY TO EXAMINE THE EFFECTS ON GROUND WATER OF THE SPECIFIC MULTIMINERAL PROCESSES THAT MIGHT BE USED. I AM NOT SURE HOW THAT WOULD MAKE A (243) DIFFERENCE FROM WHAT EXISTING OPERATIONS ARE DOING, BUT IT SEEMS LIKE THAT DATA MUST BE AVAILABLE AND IT WOULD BE GOOD TO INCORPORATE IT.

I ALSO NOTICED ON PAGE 135 THAT THERE IS A MAP OF THE AREA WHICH MIGHT BE AFFECTED BY THE LOWERING OF AQUIFERS. IT SEEMS LIKE IT MIGHT TAKE IN A 200 TO 300 SQUARE MILE AREA. MY QUESTION ON THAT IS, WHAT (244) KIND OF AN EFFECT THAT WILL HAVE ON RANCHERS IN THE AREA IF THEY NO LONGER HAVE WATER FOR STOCK PONDS.

THE STATEMENT THEN KIND OF OPTIMISTICALLY GOES ON TO SAY IT MIGHT BE NECESSARY TO TREAT WATER (245) ONCE MINING OPERATIONS ARE OVER TO HAVE IT BE USABLE FOR STOCK USES. I JUST DON'T SEE ANYONE GOING IN TO PUT A LITTLE TREATMENT PLANT AT EVER INDIVIDUAL STOCK POND. I DON'T KNOW OF ANY OTHER WAY TO GET THAT WATER BACK IN TO WHERE THE RANCHERS NEED IT.

I ALSO WAS PLEASED TO READ THAT THE

GOVERNMENT NOW EVIDENTLY HAS MADE A COMMITMENT TO TAKE RESPONSIBILITY FOR THE LONG-TERM CONTROL OF THE LEACH RESULTS FROM THE IN SITU RETORTS. I SHOULD SAY, I WAS ENCOURAGED THAT FIRST TIME THAT I READ THAT, BECAUSE IT'S BEEN THE KIND OF A COMMITMENT THAT NO ONE HAS MADE UP UNTIL NOW. BUT AS I THOUGHT ABOUT IT MORE, IT SEEMED TO ME THAT WHO IS THE U.S. GOVERNMENT REALLY? AND IT'S ALL OF US.

I AM NOT SURE THAT WE ALL SHOULD BE RESPONSIBLE FOR THE POLLUTION CAUSED BY AN OPERATOR WHO WANTS TO GO AFTER EITHER OF THESE TRACTS. IT SEEMS LIKE IT MIGHT BE MORE IF JUST THE OPERATOR WERE MADE RESPONSIBLE FOR THE LONG-TERM IMPACTS OF THAT WATER INSTEAD OF THE TAXPAYER. (121)

THE OTHER COMMENT I WANTED TO MAKE CONCERNS THE APPROVAL OF A WATER AUGMENTATION PLANT. EARLIER IT HAD BEEN MENTIONED ABOUT THE EXAMPLE OF ARCO MINE ON DELTA COUNTY IRRIGATORS. I AM AFRAID THAT WHAT IS GOING ON THERE IS NOT AS OPTIMISTIC AS IT SEEMED. THE COUNTY COMMISSIONERS IN DELTA COUNTY HAD ASKED O.S.M. NOT TO APPROVE A PERMIT FOR ARCO UNTIL A STATE WATER AUGMENTATION PLAN HAD BEEN FILED AND APPROVED. THE OFFICE OF SURFACE MINING DIDN'T DO THAT, AND THOSE WATER USERS NOW ARE IN COURT TO SEE THAT ARCO DOES TAKE CARE OF THE IMPACTS THAT IT MIGHT HAVE ON IRRIGATION (246)





WATER. I THINK TO MAKE A PARALLEL WITH THAT CASE TO THE OIL SHALE SCENE, THAT THE STATE COURT APPROVED AUGMENTATION PLAN SHOULD BE PART OF THE APPROVAL OF THE OIL SHALE MINING PLAN, THE DETAILED DEVELOPMENT PLAN.

THE IMPACT STATEMENT SEEMS TO SAY THAT PART OF THE CURRENT OIL SHALE LEASE MIGHT TAKE CARE OF THAT, BUT IF YOU READ IT, I DON'T THINK IT DOES. SO THAT'S ALL I HAVE.

CURT SMITH: THANK YOU. ARE THERE OTHERS WHO WOULD LIKE TO MAKE STATEMENTS? YES.

BILL PRATHER: MY NAME IS BILL PRATHER. I AM SPEAKING FOR MYSELF AS A RANCHER IN THE OIL SHALE AREA FOR A LONG TIME. I BELIEVE WE OUGHT TO POINT OUT SOME OF THE OTHER SIDE OF THIS THING A LITTLE BIT TONIGHT.

FIRST, I WOULD LIKE TO REMIND THE PEOPLE THAT THIS COUNTRY, WE HAVE ONE OF THE HIGHEST STANDARDS OF LIVING IN THE WORLD. ONE OF THE REASONS IS, WE HAVE HAD ADEQUATE ENERGY AND WE HAVE USED MORE THAN THE REST OF THE WORLD, BUT I LIKE MY STANDARD OF LIVING, HAVING ELECTRICITY AND ROADS AND I AM NOT TOO SURE I WANT TO GIVE IT UP.

AS FAR AS AGRICULTURE BEING ENDANGERED BY THIS, I HAVE WORKED IN AGRICULTURE ALL MY LIFE, AND IF SOMETHING DOESN'T GIVE RIGHT AWAY, AGRICULTURE IS

466



ALREADY BEING KILLED BY A WHOLE LOT OF THE SAME THINGS WE HEAR TODAY BECAUSE WE IMPACT STANDARDS OF LIVING FOR THE RECREATION. WE IMPACT THE WILDLIFE. THEREFORE, WE ARE NOT ALLOWED TO DO THINGS. I WILL REMIND YOU OF THE VERY, VERY SAD SITUATION IN AFRICA. ONE OF THE LARGEST, MOST FERTILE LANDS IN THE WORLD LIES THERE, BUT THE PEOPLE ALL AROUND IT ARE STARVING TO DEATH. IT IS SET ASIDE AS A WILDLIFE REFUGE WHERE A FEW GUIDES MAKE A LOT OF MONEY AND A FEW WEALTHY PEOPLE HAVE A LOT OF FUN SPORTING.

I THINK WE OUGHT TO KEEP THIS IN PERSPECTIVE. I AM FOR THE WILDLIFE, BUT A LOT OF THE WILDLIFE YOU ARE TALKING ABOUT HAVE BEEN BUILT UP AT MY EXPENSE, RUNNING ON MY LAND, REDUCING MY ABILITY TO RUN CATTLE. I THINK WE NEED TO GO ON WITH THESE LEASES TO LEARN WHETHER OR NOT AND HOW TO GET THIS OIL SHALE OUT BECAUSE RIGHT NOW WE ARE VERY VULNERABLE IN THIS COUNTRY TO A CUT-OFF OF OUR ENERGY SUPPLIES.

ONE OF THE REASONS I THINK WE ARE REDUCING THE DEMAND RIGHT NOW IS BECAUSE OF THIS VERY, VERY LOW ECONOMIC CONDITION WE ARE IN IN THIS COUNTRY. WHEN WE BEGIN TO PICK THAT UP A LITTLE BIT, YOU WILL SEE A DEMAND FOR ENERGY SKYROCKET AGAIN. IT WILL MEAN A LOT OF THESE UNEMPLOYED PEOPLE WILL HAVE JOBS, THOUGH. I AM NOT TOO SURE I AM AGAINST THAT. I THINK THERE





SHOULD BE SOME CHANGES IN THESE LEASES. I THINK SOME OF THE RECOVERY AFTERWARDS AND SOME THINGS COULD BE CORRECTED, BUT PRIMARILY I AM CONCERNED ABOUT THE PEOPLE THAT DEVELOP IT, NOT THESE COMPANIES, BUT THE GUYS THAT THEY HIRE TO DO THE WORK. PRIMARILY A WHOLE BUNCH OF PEOPLE AROUND THE ARMY CAMPS, THEY USED TO CALL THEM CAMP FOLLOWERS.

IN THIS AREA THEY ARE BUTCHERING MY CALVES, RUNNING OVER THE FENCE. IT'S NOT THE PEOPLE FROM THE [illegible] COMPANY. NOT THAT MANY PEOPLE WORK FOR THEM. THESE PEOPLE ARE LAYING A PIPELINE [illegible], [illegible] ANOTHER ONE, AND THE NEXT MORNING I AM SHORT A CALF OR TWO. THESE ARE THE PEOPLE WE NEED TO GET AWAY, TO DO SOMETHING ABOUT.

I REMIND YOU AGAIN, I LIVED WHEN I DIDN'T HAVE ELECTRICITY. A LOT OF DAYS I COULDN'T GET UP AND DOWN THE ROAD. THE SCHOOL WAS 18 MILES AWAY AND THAT'S SPLITTING YOUR FAMILIES IF YOU WENT TO SCHOOL. FRANKLY, I LIKE IT A WHOLE LOT BETTER NOW. I REMEMBER WHEN I COULD BUY A MALT AND A HAMBURGER FOR A QUARTER, AND MOST OF THE PEOPLE DIDN'T HAVE A DAMN QUARTER. NOW IT WILL COST YOU TWO DOLLARS TO GET YOU A MALT AND A HAMBURGER, AND YOU HAVE TWO DOLLARS AND IF YOU DON'T, THERE'S TWO GOVERNMENT AGENCIES ON THE CORNER THAT WILL GIVE IT TO YOU IN 15 MINUTES. THANK YOU.

CURT SMITH: ARE THERE ANY OTHERS LIKE TO MAKE STATEMENTS? THAT'S A HARD ONE TO FOLLOW, YES. WELL, IF THERE ARE NO OTHERS THAT WOULD LIKE TO MAKE STATEMENTS AT THIS TIME, I WOULD LIKE TO REMIND YOU THAT WRITTEN COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT NEEDS TO BE IN BY OCTOBER 7. SEND THEM TO THE BLM OFFICE IN MEEKER. THE ADDRESS IS IN ONE OF THE PAGES OF THE HANDOUT.

IF THERE ARE NO OTHER INDIVIDUALS LIKING TO MAKE STATEMENTS, THE HEARING ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROTOTYPE PROGRAM WILL BE ADJOURNED. TEN MINUTES RECESS.

(HEARING ADJOURNED AT 8:45 P.M.)

# PART 2

# COMMENTS ON THE DRAFT EIS AND RESPONSES TO COMMENTS

## B. Responses to Comments

The numbered responses below correspond to the bracketed numbers on the comment letters in the preceding section. Following the title of each response is a list (shown in parenthesis) of the letters and/or public hearings where the comment was raised. If a change to the text of the Final EIS has been made in response to a comment, that has been indicated in the response. If not, the response is an attempt to clarify a portion of the text, or explain why a particular issue has or has not been addressed.

**1. AIR QUALITY** - Model Assumptions (4, 20, 39, 52, 53, D, and G). The purpose of the EIS is to evaluate significant impacts resulting under various proposed alternatives for additional prototype oil shale leasing, and in situations where detailed information is lacking, a worst-case analysis is to be performed. The analysis also considers all secondary and cumulative impacts throughout the area of influence.

PSD permit evaluations are conducted by the responsible regulatory authority under very specific conditions (specified models, emission factors, meteorologic assumptions, limited modeling region) and the permit applies to specific operating conditions. Changes in operating conditions require permit review and possible reanalysis.

These two processes are a result of two separate Congressional mandates which complement, but do not supercede one another. It would be unreasonable to expect modeling results applied for one purpose to be totally applicable for the other. For example, for purposes of the EIS, all emissions from the Craig and Hayden Power Plants are modeled and their impacts for Mount Zirkel Wilderness are determined. NEPA requires that these predicted impacts be compared to Federal, State and local laws or requirements imposed for the protection of the environment. However, only one unit of the Craig Power Plant is subject to the PSD permitting procedure; PSD compliance determinations apply only to that permitted portion of the facility.

Regulatory agencies cannot issue permits resulting in air quality violations and BLM lessees cannot conduct their activities in violation of any applicable air quality standard or related plan of implementation. Letter 53 lists several mechanisms available to regulatory agencies which allow development when preliminary analyses predict exceedances of air quality standards, and still maintain clean air requirements.

**2. TEXT CHANGE**. The text has been changed for clarification.

**3. WILDLIFE** - T/E Consultation (8). Additional consultation under the Endangered Species Act has been identified as committed mitigation. This will be performed when the necessary information becomes available on water requirements for lease development. This stipulation is based upon information in the biological assessment dated 16 July 1982 (Letter 1) and is described in the baseline assumptions in Chapter I of this document.

**4. BASELINE** (10, 15, 18, 23, 40, 43, 52). The baseline described in the Draft EIS has not been changed. While it is recognized that some of the projects assumed under the No Action Alternative have been temporarily halted or slowed, it is also assumed that they could just as quickly start up again.

As the economy improves and markets change, the baseline could easily become fact and could even become an understatement of reality. Given the rapidly changing portrait of energy and mineral development in the region, it is by no means unrealistic to assume the No Action scenario. The Draft EIS stated the ephemeral nature of the baseline, and that it had been established as a basis for analysis only. Some commenters pointed out that Multi Minerals Corporation has disassociated itself from the proposed sodium mine on Tract C-18. An approved mine plan still exists, however, so the sodium mine remains in the baseline. References to Multi Minerals Corporation have been deleted.

As a tool to better understand the components of the baseline, information has been prepared to assist the reader in understanding the incremental impacts caused by several of the key projects assumed for the No Action Alternative. The Summary of the Final EIS shows critical population impacts by project for Meeker and Rifle. Table IV-2 shows critical air quality impacts by project.

**5. SOCIAL** - Methodology (10, 38, 49). This criticism is well taken with respect to empirical methodology in social sciences. However, the function of

Table IV-18 was not to indicate levels of impacts specific to this particular analysis, but to provide a theoretical model of the total social change process within which any community might fit its own case of energy boom impacts. The model is intended to be a *general* summary of what happens to any community undergoing energy project impacts, according to the prevailing literature in the field (as noted in the first footnote in the table).

The actual severity of impacts, and their specific components would reflect, for any community, its initial size, history, location, level of capacity and preparation for growth, social structural state, demography and community value system.

The evaluation of social impacts on youth in a boomtown situation was based primarily upon evidence indicating that population diversification with its destruction of community traditions tends to produce both psychological discomforts over the loss of cohesion, and opportunities for greater diversity in social contacts and activities. Since the youth are brought into contact with new and different young people (especially in school), it was assumed that they would experience both negative and positive psychological impacts, but that their interaction opportunities would improve because of the diversification. The conclusion that psychological impacts would include the negative was based upon the significant research findings of the commenter in his boomtown youth studies.

Since the theoretical nature of Table IV-18 and Figure IV-12 was apparently not made clear in the text, Chapter IV, Social has been rewritten and rearranged to correct this deficiency.

**6. EDITORIAL CORRECTION**. Editorial changes in the text have been made.

**7. AIR QUALITY** - Acid Deposition (13, 39, 50, D, G). The likelihood of impacts due to acid deposition was not dismissed by referral to a "Federal five-year study". However, there are no generally accepted methods for estimating incremental effects of sources on acid deposition and acidification. With information provided since the Draft EIS was prepared, additional deposition analysis has been performed and included in the Final EIS with additional interpretation. Due to the state-of-the-art of predicting acid deposition impacts, the current analysis should be considered as a preliminary first approximation, and considerable improvements are anticipated in the future.

**8. OTHER ENERGY ALTERNATIVES** (13, 38, 39, D, G). Chapter I, Issues Raised During Scoping But Not Addressed in This EIS, has been changed to explain why conservation and other energy alternatives have not been analyzed in this EIS.

As stated by several commenters, numerous studies are currently available that compare conservation, oil shale and liquid fuel as energy alternatives.

**9. AIR QUALITY** - Air Quality Related Values (13, 17, 44, 49, D). Impacts to AQRV's were only considered in PSD Class I areas. The preliminary nature of the proposed action and the state-of-the-art in AQRV impact assessments limited analysis to only visibility and acid deposition although other AQRV's have been identified in the Class I areas. Based on the inconclusive state of research in the area, it was determined that definite effects could not be identified.

Level 1 screening of potential visibility impacts to Dinosaur National Monument, Mt. Zirkel and Flat Tops Wilderness Areas from prototype lease tract development was performed. Potential impacts to the other PSD Class I areas are less likely due to their increased distances from the source. Acid deposition analysis and interpretation has been expanded in the Final EIS.

**10. NET ENERGY ANALYSIS** (14, G). The Draft EIS addresses the energy requirements for oil shale production in Chapter IV, Net Energy Analysis. While oil shale processing is energy consumptive, our analysis shows that, at a minimum, oil shale returns in energy twice what it consumes.

**11. SOILS** - Surface Disturbance (15, 23, 45). Although the amount of disturbance and potential for soil loss (erosion) are greatest for the true in-situ technology, this disturbance and soil loss can be reclaimed with technology which has proven to be effective in the Piceance Basin. It is felt that the direct mining with surface retort and mine assisted in-situ technologies are potentially more impacting to the soil because they may require the stabilization and permanent storage of toxic materials in or near the rooting zone of plants using technologies which have not been tested at commercial scale. Chapter II, Development Scenarios states that the majority of disturbance associated with true in-situ development is temporary.

**12. WILDLIFE** - Road Kills (15, 45). The estimated number of deer road kills is based on projected traffic increases (see Chapter IV, Transportation), and data collected by C-b Tract during 1980 and 1981 indicating frequency of deer road kills (see Table IV-16). These figures have been rechecked and are accurate. The reason for the noticeable difference in number of road kills between tracts is due mainly to the assumption of the existing sodium lease on Tract C-18 under the No Action Alternative. Because of this, transportation and road kill estimates in the C-18 Alternative were based mainly on requirements for transporting oil

shale products. If transportation and road kill estimates for the No Action Alternative, including the existing sodium lease, and the C-18 Alternative were combined, they would be very similar to those calculated for the C-11 Alternative.

**13. HYDROLOGY** - Groundwater (15). The discussion in Chapter III, Hydrology concerning the movement of groundwater up from the lower aquifer through the Mahogany Zone into the upper aquifer is a general description of basin movement. Refer to Weeks et al (1974).

**14. AIR QUALITY** - Emissions Assumptions (15, 18, 23, 39, 47, 48, D). The emissions inventory was revised to reflect suggested changes, making it more consistent with inventories used on other studies in the region. Considerable variation in emission estimates should be expected due to the general uncertainity of process technologies (i.e., no commercial scale oil shale facility has been constructed and monitored).

Emissions proportionate to Cathedral Bluffs' operation were used for the mine assisted in-situ estimates. Union "B" retort estimates represent the direct mining/surface retort technology. Emission values for these processes were obtained from PSD permit applications. As indicated in the impact analysis technical report (Dietrich et al 1982a), nearly 40 percent of the mine assisted in-situ TSP emissions come from the Lurgi process stacks. The MIS gas desulfurization process accounts for 89 and 80 percent of the total $SO_2$ and $NO_x$ emissions, respectively.

**15. WILDLIFE** - Management (16, M, G). Your comment is correct in stating that additional leasing will place additional strain on wildlife. However, the opinion of Bureau of Land Management and Division of Wildlife biologists is that with continued research and studies, plus implementation of successful mitigation, herd objectives and habitat conditions can be maintained. Thus, additional leasing is not necessarily in direct conflict with the Division of Wildlife's goals for wildlife management.

**16. PROGRAM OBJECTIVES** (16, 18, 19, 26, 38, D, M, G). The commenters are referred to the objectives stated for the Prototype Oil Shale Leasing Program in Chapter I. The Department of Interior is still attempting to meet these objectives, as stated in Chapter I, Issues Raised During Scoping But Not Addressed in This EIS, (a.). This action is a continuation of the original prototype program. The Department feels there may be a need for offering tracts for the development of oil shale concurrently with associated minerals under the prototype program. The Department will not grant a lease unless an equitable return to all parties (bonus bids, royalties, etc.) is assured.

**17. HYDROLOGY** - Groundwater (16). There are Federal regulations which require any exploration drill holes to be properly cased and plugged with cement during and after use. Properly placed plugs will prevent the movement of water between aquifers. Before drilling can take place on Federal land, an Environmental Analysis needs to be done. For additional information contact the Water Resources Division of the U.S. Geological Survey.

**18. LEASE** - Reclamation (16, 19, 37, 38). Section 11 and Section 14 of the Environmental Stipulations are applicable to each other. No section of the lease is intended to stand on its own. In this case, where Section 14 states that spent shale must be stabilized for revegetation, the stipulations for revegetation in Section 11(b) would apply. Similarly, where Section 14 requires selection and preparation of disposal sites for wastes to avoid downward percolation of leached products and other pollutants in aquifers, the provisions of Section 9, Pollution Water would apply. In both cases, the lessee must demonstrate in the Detailed Development Plan how this will be accomplished and what techniques will be used.

**19. DEVELOPMENT SCENARIOS** (17, 23, 38, 45, 48, D, M). The EIS has looked at three potential development technology scenarios: direct mining and surface retorting, mine assisted in-situ processing and true in-situ. These scenarios are not intended to be comprehensive or to reflect all possible methods of oil shale development. They have been selected as representative of a range of potential development scenarios, so that the impact analysis can evaluate a range of potential impacts. An analysis of *all* possible technologies would be impossible and inappropriate for this EIS. If the decision is made to lease, the successful bidder will be required to specify the development technology to be used. The maturity and potential of the development technology proposed at that time will be evaluated by the Minerals Management Service. The lease requires that measures be taken to assure that all applicable environmental standards be met. Further limiting potential development proposals prior to lease sale would be inappropriate, as stated in the EIS, Chapter I, Issues Raised During Scoping But Not Addressed in This EIS, (c.).

**20. AIR QUALITY** - Regulations (17, G). Section 11 of the Oil Shale Lease and Sections 1(E)c and 8 of the Environmental Stipulations provide considerable provisions for limiting the impacts of lease development on air quality, but these are not the only requirements lessees must meet. Several Federal and State air quality permits and licenses must also be obtained prior to on-site development. As long as lessees comply with post-operation requirements

(especially successful reclamation) no further air quality controls should be necessary.

As an uncommitted mitigation measure, BLM recommended that "additional background monitoring to better assess regional impacts" be performed. Section 10 of the Oil Shale Lease and Section 1(c) of the stipulations already establish a procedure whereby a Mining Supervisor approved monitoring program must be implemented.

**21. RECREATION** - Visitor Use Impacts (17, 18). Based on current recreation statistics, it was determined that while there would be an increase in visitors to Wilderness Areas and National Park Service lands due to population increases resulting from oil shale development, visitor use impacts would not be significant. The recreation discussion focused on hunting use since this would be anticipated to cause the most significant impacts.

**22. LEASE** - Public Review (17, 37). The opportunity for public review is already provided through the Oil Shale Environmental Advisory Panel, an existing public review process. Some decisions made by the Mining Supervisor are necessary for ease of management, and are made without a formal public hearing.

**23. LEASE** - Environmental Stipulations (17). The referenced statement in the lease stipulations was not meant to imply a lesser standard and has therefore been deleted from the stipulations under both Section 8, Pollution-Air, and Section 9, Pollution-Water. Applicable Federal and State air and water standards address this, as stated in the stipulations.

**24. CUMULATIVE ANALYSIS** (18). The analysis is cumulative.

**25. AIR QUALITY** - Model Assumptions (18, 45, G). The BLM does not subscribe to the theory "if it's already dirty, why worry about making it dirtier", nor does it believe additional prototype lease emissions would not contribute to the deterioration of Western Colorado's air. The EIS examines various alternatives of prototype lease development under the same conditions other existing and planned developments were analyzed. The EIS clearly states prototype lease related emissions "will have an unavoidable, adverse impact on air quality". Since most predicted pollutant concentrations were within half of the most stringent standards (except at 100,000 bbl/day production) these impacts were described as "minimal".

Predicting what the regional oil shale production will be ten or twenty years distant is speculative. For example, in two recent analyses (Colorado Department of Health 1982b and Pedco Environmental, Inc. 1982) production scenarios varied between 180,000 and 1,163,000 bbl/day. Any decision should consider the likelihood of compliance with all applicable air pollution laws, but in situations where the modeling approach is admittedly conservative with a tendency to overemphasize impacts, the results should not necessarily be construed as a basis not to lease.

**26. MITIGATION** (18). Mitigation measures included in the Summary are not intended to be specific or complete, but a summary of committed and uncommitted mitigation measures identified elsewhere in the text. Mitigation measures in Chapter IV have been written as detailed and specific as possible given the level of detail of this document.

**27. LEASE** - Concurrent development of other minerals (19, 33, 34, 35, 38, 45, 46, D, G). The intent of the Department of Interior has always been to require the development of shale oil, nahcolite, dawsonite and other minerals on these leases. Section 12 of the lease and 30 CFR 231 require that leased minerals not be wasted. However, in order to clarify the Department's intent to see development of associated minerals with the oil shale, the lease has been clarified in two places:

> Section 1, Definitions (a) "oil shale" -- the definition includes these other minerals. Nahcolite and dawsonite have been specifically added to the definition. By this definition, then, "Leased Deposits" include these and other associated minerals.
>
> Section 10, Development Plan and Diligence Requirements (a) has also been strengthened to require the lessee to identify when the minerals will be developed in the Detailed Development Plan.

**28. LEASE** - Environmental Stipulations (19, G). The Prototype Oil Shale program is not intended to be a research program. The commenter's opinion that a full range of environmental safeguards and restoration techniques are not being developed at existing prototype leases is inaccurate. The commenter is further encouraged to examine the environmental stipulations of the lease (Appendix A) where mitigation measures and monitoring requirements are specifically delineated.

**29. HYDROLOGY** - Groundwater (19). As stated in the Draft EIS, present groundwater use in the Piceance Basin is minimal. Aquifer mixing would only occur provided that none of the mitigation measures are incorporated. In addition, groundwater movement throughout the Piceance Basin is slow, in the order of hundreds of years. Chapter IV, Hydrology, Leaching of Subsurface Retort Chambers, has been expanded to clarify this.

**30. WILDLIFE** - Mule Deer (19). Tables IV-14 and IV-15 were constructed to summarize estimat-

ed reductions in mule deer carrying capacity for each alternative and development scenario. Table IV-16 summarizes estimated annual increase in vehicle related road kills. A total impact table was not made because combining the estimates from the three tables is not practical since carrying capacity impacts are entirely different from annual road kill mortalities and are not additive. The tables have been summarized to the extent possible to provide estimates to allow comparison of the magnitude of impacts among alternatives, development scenarios and production levels.

Current literature on the subject and consultation with the Colorado Division of Wildlife indicate that there is no accurate method of predicting stress-caused mortality. Stress-caused mortality will undoubtedly occur, but to an incalculable amount.

Impacts to mule deer fawning areas would not occur from tract development. Disturbance to big game summer ranges, including fawning and calving areas, could occur from secondary off-tract impacts as discussed in Chapter IV, Wildlife.

The effect of molybdenosis on mule deer is described in Chapter IV, Wildlife, On-Tract Physical Destruction or Alteration of Habitat. Also under this subheading is information on potential inadequacies of reclamation technology for replacing wildlife habitat and resulting consequences to wildlife populations. The approach taken to estimate impacts from destruction or alteration of habitat was based on the assumption that Oil Shale Lease Environmental Stipulations, Section 4, Habitat Management and Section 11, Rehabilitation would be adhered to (see Appendix A).

**31. AIR QUALITY** - Pollutant transport (19, 39, 49, 50). Indeed, modeled results do not indicate prototype plumes would be transported directly towards Rifle. Detailed plume trajectories displayed in the impact analysis technical report (Dietrich et al 1982a) show prototype plumes move south (northwest winds) under influence of the Parachute Creek drainage until they reach the Colorado River, where they turn to the southeast.

Under a west wind condition in the Draft EIS, sources in the Parachute Creek drainage encounter elevated topography west of Highway 13, forcing the trajectories southward. Sources in the Piceance Basin are located further north and do not encounter the same ridge line.

In the Draft EIS, the northwest wind analysis for the No Action Alternative did not include either the prototype emissions or the two new programmatic leases. The changes in impact region identified were due solely to these programmatic leases, which are not included in the Final EIS analysis, in order to make the Air Quality Section consistent with the assumptions in the rest of the document.

Cumulative impact analysis is one aspect of the environmental assessment of potential prototype leasing alternatives. Cumulative impact estimates intentionally examine overall development on the region, regardless of technologies involved.

**32. AIR QUALITY** - Model limitations (20, 22, 29, 40, 44, 45, 47, 48, 49). Several qualifications describing limitations in the modeling approach have been incorporated into the Final EIS (particularly in the Summary section). These additional descriptions of the limitations had appeared in the impact analysis technical report (Dietrich et al 1982a), and do not represent a change in the quality of analysis performed. Although the models used (and in fact all models) have certain limitations, the results represent a best approximation of potential worst-case impacts under the conditions assumed.

Worst-case analyses, such as the one used, may estimate high pollutant concentrations since worst-case emission, source siting, and meteorologic assumptions are used. These analyses are performed to provide an indication of potential problem areas. Site specific air quality analyses such as those required in the regulatory process would be expected to provide more realistic (accurate) results. Since the approach used for this EIS is absolute worst-case, site specific modeling may yield lower concentration values.

**33. AIR QUALITY** - Model used (21, 22, 29, 39, 44, 48, 50, 52). To date, no model has been adequately validated (comparing measured ground level concentrations to modeled predictions under a variety of conditions) in complex terrain or on a regional scale. The BLM will be operating twenty-one real time meteorologic stations in the Oil Shale region of Colorado, Utah and Wyoming in 1983 to evaluate the WINDS model's short-term response in the same manner the Fosberg (1980) and Dietrich studies (1981) evaluated climatic response. The terrain in San Diego County is indeed complex where inland terrain is up to 1800m higher than surrounding coast and deserts. The North Dakota study (Schock 1981) evaluated several models for applicability where source receptor distances are greater than 50km and determined MESOPUFF and RTM were most appropriate. In an independent study, MESOPUFF was again found to be the most scientifically sound model for use in North Dakota's situation (47 FR 42806). CITPUFF, the model used in this EIS, is in the same generic class as MESOPUFF.

**34. AIR QUALITY** - Impact analysis (4, 21, 22, 44, 47, 48, 49). The high values in the Draft EIS west of Rifle are unrealistic because pollutant puffs

stagnate within a flawed wind field. This problem has been corrected by allowing puffs to move outside the convergence area. Therefore, concentration values west of Rifle reported in the Draft EIS were unrealistically high in stagnant areas (especially when 24-hour wind persistence is assumed). However, high pollutant concentrations resulting from plume stagnation do indicate potential air quality problem areas.

**35. SOCIAL** - Impacts and mitigation (21). Negative statements on social impacts are supported by the prevailing literature on the subject. As better and more complete data become available on specific communities and on specific aspects of social change in energy-affected areas, refinements in analysis will become possible, of course. The need for cooperation among government, industry, and the citizenry for social mitigation is addressed in Chapter IV, Mitigation Measures That Could Further Ameliorate The Anticipated Impacts But Are Not Required By BLM (Uncommitted Mitigation).

If mitigation and/or prevention measures are taken, the social and economic disruptions would be greatly reduced or perhaps even eliminated. Such preplanning, expenditures, provision of housing, social services, etc., *in advance* of arrival of construction workers, have not usually been carried out, however. For purposes of evaluating potential social and economic impacts, these techniques cannot be assumed, since they cannot be mandated.

**36. ECONOMICS** - Model (21, 44, 47, 48, 49). The economic analysis used baseline inventory data collected by the Colorado Department of Natural Resources and the Planning and Assessment System (PAS) economic base model built by Mountain West Research, Inc. The results are similar to, but not identical with, those of the Cumulative Impacts Task Force (CITF) because BLM used different assumptions regarding certain of the oil shale projects -- notably the Federal tracts C-a and C-b. The proposed lease tracts were entered into the model in the same way, and computer runs were made with and without the tracts in all combinations. Differences between the runs comprised the employment impacts, which were expanded into population impacts using standard relationships, with allowance made for single construction workers. Because the community allocations part of the CITF model was not operational, this was done manually and based on data from the other oil shale projects.

**37. SOCIAL** - Mitigation (21). These summary statements in the text reflect definitions for levels of severity defined at the top of Table IV-20. Since no authority permits BLM to require social mitigation, an analysis must assume a "non-mitigated" case. The residence locations assumed are defined in the population distribution model discussed elsewhere; the Colorado State policy generally discourages development of new towns, and company decisions regarding onsite employee housing cannot be assumed for analytical purposes. Mitigation by this method would potentially raise other issues for social impact analysis.

**38. ECONOMICS** - Model (21, 45). Employment allocations to communities were developed from data supplied by oil shale projects in the area to the Colorado Department of Natural Resources. Of course, actual results will often differ from any such projections.

**39. SURFACE RECLAMATION** - Backfilling spent shale (21, 49). There seems to be somewhat of a difference of professional opinion. Bloomfield and Stewart (1981) stated in their research that "Underground backfilling can reduce the surface environmental impact of retorted shale disposal by reducing the land area required to 15 to 30 percent of that required for total surface disposal. From 70 to 85 percent of the retorted shale can be placed back in the mine." This statement is based on the expansion of an average grade of raw shale of 28 gallons per ton with an in place density of 129 pounds per cubic foot.

**40. SOCIAL** (21). The text discussion is a typical case, referring to an influx of new construction workers. It is intended as a summary of discussion in Chapter IV, Social, which touches on the commenter's points.

**41. ECONOMICS** - Community revenue (21). Community revenue projections include residential and commercial property taxes and sales taxes. They are projected on a per capita basis, therefore they include the effects of both direct and induced population growth.

**42. ECONOMICS** - Community revenue (21). "Projected revenues" refers to the total revenues projected for the communities under the No Action Alternative. The only fiscal impacts estimated for the other alternatives were those on property and sales taxes. No budget deficit is implied. An addition has been made to the text to clarify this point.

**43. SOCIAL** - Crime (21). The general rise in crime was noted by interviewees (including law enforcement personnel in Silt) in several communities in this energy-affected region during the summer of 1981. From their comments it is assumed that the increase in crime would be faster than the population growth rate, and is explained only in part by improved reporting procedures. The increase is attributed to energy growth (and to some extent also to tourist industry expansion in the Glenwood area).

**44. SOCIAL** (21). The statement referred to is not statistical, but is clearly attributed in the text to the experience of a specific interviewee whose role in the community lends some validity to it. It should obviously be taken only as "best evidence", subject to refinement with data.

**45. SOCIAL** (21). The formalization of local governing processes is certainly not a phenomenon confined to small towns whose growth is energy-related. Such bureaucratization occurs as a social structural change in any community (or any organization at all) as it becomes larger and requires more complex coordination of activities and decisions, especially if the membership of the group becomes at the same time more diverse in backgrounds, needs and interests.

**46. SOCIAL** (21). That "boom" conditions bring about both social changes and social-psychological stresses for some individuals of a community is well documented by studies of boom towns reported in the literature on energy development.

**47. SOCIAL** (21). Interviews with Rangely leaders and citizens done in 1980 by the author of this section (also documented by Margolis for prior years) indicated a strong desire to draw new population and economic development to this isolated town around which gas and oil wells were becoming depleted. The new Western Fuels and Deseret Generating projects have brought facility and service overloads (especially housing shortages) and many new workers to Rangely. Recent comments have suggested that these rapid changes have caused many citizens to feel some concern that the traditional character of the community is being lost.

**48. ECONOMICS** (21). The paragraph in which the seven percent property tax increase limit is mentioned refers to annual operating revenues only. Major new construction is generally not financed from these sources but is financed, instead, by bond issues or other debt instruments. That subject is discussed in the following paragraph of the text.

**49. SOCIAL** (21). The text discussion here refers to the general descriptive model concerning the entrances and exists of construction workers on energy projects. Different types of projects will vary somewhat from these patterns, and construction can, of course, be slowed or staggered among projects as a mitigation technique. Also, certain continuing construction workers are considered operations workers (for instance, the construction workers in underground mines who build the supporting structures as mining progresses). That some construction workers are not transient is discussed in Chapter IV, Social.

**50. SOCIAL** - Quality of life (21). The conclusions regarding severity of social impacts on various communities for various alternatives are based upon boom town studies indicating that social impacts are directly related to given annual growth rates. Estimates of the severe level range upward from growth rates of five percent. We have used estimates on the conservative side, as defined at top of Table IV-20.

The term "quality of life" is a generic term that, like "community well-being", has never been rigorously defined. In energy related social impact analysis, the term usually refers (as it does in this document) to those aspects of the human environment which provide citizens a sense of social participation and acceptance, physically healthful and comfortable surroundings, financial security, psychological and emotional comfort, and community pride. That the specific requirements of individuals differ is irrelevant to this document, as long as most of the perceived needs are reasonably well met. Better data would obviously make possible a more rigorous definition for "quality of life", and a better analysis of it.

**51. SOCIAL** - Winners/losers (21, 38). Some oldtimers are not only strong proponents of development, they often gain substantial social benefits from community growth -- lower food prices and better shopping facilities, for instance. Nevertheless, the small town atmosphere and ethos are permanently lost through boom growth, and most oldtimers express a sense of psychological distress from the loss.

**52. SOCIAL** - Winners/losers (21, 38). The question of "winners and losers" is addressed in Chapter IV, Social, Quality of Life.

Data on age, income, and other demographic variables on existing population would be interesting for better analysis, but would not answer questions regarding just how many, what proportions, or precisely which persons would "win" or "lose", since we lack reliable information on the characteristics of incoming workers or on the demographic changes in impacted communities, from which predictions could be made.

With respect to social impacts of energy-related growth on the elderly, available research data are of two types: objective indicators such as income and employment comparisons among age groups (which seem to show the elderly as economic losers); and survey data in which the elderly themselves are asked to describe their feelings and experiences. Most discussions of social impacts on the elderly have painted a bleak picture based upon their supposed economic deterioration, and

upon common sense speculations about the destruction of social networks.

However, evidence from actual economic analysis indicates that shopping choices and lowered prices are beneficial impacts, and the inflation of property values has positive implications for long-term home owners.

Likewise, surveys of the elderly actually being affected suggest that they may not feel worse than other citizens, and may feel better, for several reasons. For instance a study in Gillette, Wyoming (Pattinson, Weisz and Hickman 1979) showed that the lowest stress levels were associated with the older ages.

Freudenburg (1982) reviews the major literature, including his own work in Craig, and indicates that three factors may explain why the social well-being of the elderly may not decline (in addition to economic advantages mentioned):

(a) Psychologically, the very fact that older people are more set in their ways may make possible the maintenance of an internalized continuity in their lives in the face of external change. (They may have learned to weather changes because they have experienced so many changes over their lifetimes.)

(b) Socially, though the streets may be full of strangers and they now feel the need to lock their doors, the social networks of which they are a part may not be touched much so their social support systems probably do not break down after all.

(c) Culturally, elderly long time residents have lived through the lean times when they feared for the future of their home communities, so they have a strong set of positive attitudes about seeing the town prosper, with better opportunities for the young.

These data are by no means conclusive; much more research is needed. But a second set of data lends further credibility.

Freudenburg (1979a and 1979b) has also found evidence that it may, in fact, be the youth of a boom town who suffer the most negative impacts. The students of a boom town showed significantly greater levels of negativism, distrust, cynicism, etc., than did a control group of students from three non-boom nearby communities. He tentatively explains this in social-psychological terms: Teenage young people are actively in the process of establishing their individual identities as adults at a time when all the traditional social supports and controls are being disrupted. Since the students (unlike the elderly) are forced into daily direct contact with newcomers at school, they are, he believes, less able to maintain familiar social networks because the networks themselves are in flux.

It is not possible at the present time to evaluate the validity of these findings, but it cannot be said that older citizens are necessarily heavy losers, or that the young have all the best benefits.

Higher property taxes from inflated property values may be a problem for an elderly homeowner; a renter may also be adversely affected financially. An elderly homeowner who sells will generally benefit. Thus there are winners and losers within this age category on this basis.

The notion of fixed incomes for the elderly is not totally valid, since social security and many pensions are tied to cost of living increases.

Most studies of pre-impact attitudes in small rural communities have shown an interesting paradox in that citizens asked to describe what they like most and what they like least about their communities generally respond in terms of contradictory characteristics: They will say they like least the poor shopping facilities and like most the small close-knit "know-everybody" context, for instance. Thus it is inevitable that there are gains in one element at the cost of losses in another. These trade-offs affect everyone probably with a net gain.

**53. SOCIAL** (21). Even though official figures would be inflated by better reporting procedures and by more and better services delivery, there remains evidence from studies that a higher proportion of persons would be negatively impacted. Text wording has been changed to clarify this point.

**54. ECONOMICS** - Benefits of growth (21). The beneficial effects mentioned do occur over time, but not in the early years of growth. It is the annual rate of growth, not the overall magnitude, that determines the severity of impacts. Local inflation normally accompanies rapid growth, at least in the early years.

**55. ECONOMICS** - Short-term/long-term (21). Positive short-term economic effects would occur, and they are described in Chapter II, Description of Alternatives in the impact summaries, and in Chapter IV, Economics. The emphasis in the section on short-term use versus long-term productivity is on the duration of those impacts which are adverse.

**56. SOCIAL** (21). Social impacts are not subject to "reclamation" -- communities cannot revert to the same former social state, though they can lose some gains, return to a smaller population size, etc. Life styles and values would be permanently different from (not necessarily worse than) pre-development times, and thus the original state would be lost.

# PART 2

**57. ECONOMICS** - Taxes (21). The comment on prepayment of ad valorem taxes is correct, and the text has been changed accordingly.

Like any special purpose analysis, an EIS has a particular focus. There are issues of economic feasibility pertaining to the raising of severance taxes, but they are outside the scope of an impact analysis. Higher severance tax revenues would increase impact mitigation capability.

**58. ECONOMICS** - Housing (21). Most of these points are made in the text. Providing motel type accommodations, except for extremely transient workers, would not generally be considered a satisfactory mitigation measure.

**59. AIR QUALITY** - Model (22, 38, 39, 48, 53). The EPA modeling guidelines (EPA 1978) and proposed revisions do not recommend any specific model in complex terrain nor on a regional scale for regulatory purposes. In general, VALLEY is suggested as a screening technique with COMPLEX I or COMPLEX II as suitable replacements, but these "straight line" models assume persistant wind conditions at the source and hold these conditions constant over the entire plume trajectory. These models are also not suggested for trajectories over 50km. Exclusive application of these models for this EIS would be inappropriate.

The EPA has tentatively approved use of a model similar to TAPAS for evaluating PSD permits in a specific situation. Also, CEQ regulations (40 CFR 1502.24) on implementing NEPA requirements emphasize "scientific integrity" but do not require utilization of regulatory impact analysis techniques. In fact, as with the situation at hand, regulatory techniques might not meet the "scientific integrity" test. Congressional mandates under NEPA and the Clean Air Act are intended to complement, rather than supercede one another.

**60. AIR QUALITY** - Model (22, 44). We agree that from a permitting perspective, only that model used in issuing the PSD permit assumptions should be used to assess PSD compliance. The air quality analysis is not intended as a regulatory analysis and would not satisfy those requirements. NEPA, however, requires that anticipated impacts be compared to Federal, State and local environmental protection laws or requirements (including PSD increments) in order to determine the severity of impact (40 CFR 1508.27).

**61. AIR QUALITY** - Model (22, 48, 49). The WINDS/CITPUFF modeling does not violate the principle of mass conservation. The WINDS model is, in fact, based upon the mathematical representation of precisely that principle. Solution of this equation in two dimensions, however, does generate certain unrealistic wind patterns. The model is based upon calculating a divergence and vorticity field which results from the topographic (and thermal) influences on the mean flow. Detailed derivations of the algorithms used are presented in the supplemental impact analysis technical report (Dietrich et al. 1982b). Fundamentally, the model calculates wind corrections to the mean flow by application of the integrated mass conservation equation.

The model assumes that at the top of the mixing layer the vertical velocity is zero, and that at ground level the vertical velocity component is given by a flow parallel with the surface.

This approximation fails in areas where the topography is particularly steep because unrealistically large velocities parallel to the surface are generated, resulting in high divergence (or convergence) fields. Thus while the comment is incorrect that mass is not conserved, it is correct in the observation that a "circular" pattern of wind is generated which causes the puff to cross and recross the same grid point many times. Physically, such a phenomena is not impossible, but it is entirely unrealistic since, as the commenter observes, vertical winds (other than simply parallel to the topography gradient) would be operative, as well as a host of other physics not included in the model. In summary, we agree that the analysis is overly conservative in such situations.

Based upon this and related comments, the Draft EIS results were examined to identify in which locations WINDS model results were questionable. Two general locations were identified, including northwest of Rifle where a 1,500m elevation change is encountered in one grid cell. This generates a remarkably high vertical velocity of 4 X 1500/2900 = 2.1 meters/sec. and divergence of approximately .001 per sec, which is nearly two orders of magnitude above normally encountered divergence fields. Similar elevational gradients are encountered near the Book Cliffs. In these two areas, the modeled wind field is unrealistic.

The effect of such an unrealistic wind field leads to repeated visitation by a puff at the same grid point. In the technical report the effect of such a multiple dose of pollution is indicated to generate concentrations an order of magnitude higher than a typical EPA screening model (e.g., COMPLEX II) would generate. For analysis in the Final EIS, the puff is moved through the area after initial stagnation at an independently determined wind speed. Thus a realistic maximum concentration is provided in the analysis.

**62. GENERAL** - Comparison of impacts (23, 45). The purpose of the EIS is to compare the environmental impacts of each alternative, development scenario and production rate for the two tracts. The

conclusion that leasing one tract would have more or fewer impacts than leasing another tract for a particular resource value is a legitimate conclusion based on a comparison of specific development scenarios applied equally to both lease tracts.

**63. GENERAL** - Precluding future development (23). This is the purpose of proposing to lease additional prototype tracts -- to stimulate technology appropriate for this part of the Piceance Basin. Failure to lease under the Prototype Oil Shale Program will not block development in this area, however, since the Department of Interior is in the process of developing a long-term, commercial oil shale leasing program that may also make tracts in the Basin's depositional center available for development.

**64. GEOLOGY** - In-place reserves (23). The estimated in-place reserve figures are correct as shown.

**65. LEASE** - Minimum royalties (23, 37). The minimum royalty described in Section 7(e)(1) of the lease will differ for each of the two tracts, and therefore annual production rates on which royalty is based were not specified in the lease. They will be announced in the notice of lease sale as follows:

| Tract | Shale Grade (gal./ton) | 6th Year Production Rate (tons/year) | 15th Year Production Rate (tons/year) |
|---|---|---|---|
| C-11 | 30 | 2,190,000 | 21,900,000 |
| C-18 | 30 | 1,943,000 | 19,430,000 |

Annual production rates assumed for the two tracts differ slightly because the stratigraphy of the deposits is different, thereby affecting recoverability.

**66. WILDLIFE** - Mitigation (23, 49). Situations which may warrant application of this stipulation include but are not limited to: (1) excessive snow depths, (2) crusty snow conditions, (3) low temperatures, (4) poor condition of animals, or a combination of these situations. This restriction would not apply to the major areas of intensive use such as the main access road or mine facility site, but to secondary areas where activity is unnecessary or can be scheduled to avoid occurence during this time period. This allows for continuous tract operation yet also provides areas where deer can reside with minimal disturbance.

**67. GEOLOGY AND MINERAL ACTIVITY** (23). The statement that "oil and gas exploration and production could continue unimpeded and temporarily prevent extraction of 72 percent of the in-place oil shale per acre" is not in conflict with any other portion of the EIS. This statement is made in Chapter II, No Action Alternative, Summary of Impacts.

**68. GEOLOGY AND MINERAL ACTIVITY** (23). Specific stipulations concerning oil shale protection may or may not exist in the existing oil and gas leases depending on when the leases were written. 30 CFR Part 221.18 enables the Minerals Management Service to amend the leases. Considering the above, and the current policy of subordination of oil and gas to oil shale, an Application for Permit to Drill would be denied if oil shale could not be protected.

Discussion of the potential constraints on oil shale recovery due to conflicting oil and gas operations is discussed in Chapter IV, Geology and Mineral Activity. Listing of the current lessee and the duration of each lease is not pertinent to this analysis. The important thing for the reader to keep in mind is that the tracts are usually 100 percent leased for oil and gas, and that the leaseholders and expiration date of each lease change frequently.

**69. GEOLOGY** - Resource recovery (23, 48). The recovery percentages presented in the EIS are based on current industry projections and USBM experimental mine recoveries. Percentage recoveries would be much higher if mine pillars were extracted under full subsidence mining. See the Subsidence section of Chapter IV, Geology. Current underground mining technology is limited by the requirement to prevent subsidence to protect overlying resources and aquifers. Areas that are mined by underground or mine assisted in-situ methods may be subjected to surface mining in the future with subsequent increases in resource recovery.

**70. GEOLOGY** - Resource recovery (23). The statement that "Recovery utilizing true in-situ dissolution mining is presently unknown" only refers to actual recovery. The statement is not intended to say there is no in-situ dissolution recovery method. The method may be applicable and technically feasible within the saline zone as stated in previous sentences of the paragraph in question.

The technical basis for stating that recoveries should probably be highest for direct mining is based on the small stope created at the Bureau of Mines site by Multi Mineral Corporation and industry research in room and pillar mining of oil shale and mining competent microcrystalline saline minerals in the saline zone.

**71. ALLUVIAL VALLEYS** (23). No alluvial valley floors have been identified in Ryan Gulch or Horse Draw, no formal determination of their existence and extent have been made, and it is not intended

to disallow development in the area described in the EIS as alluvial valleys. It may be necessary to design stipulations which would limit development of alluvial valleys to protect water quantity and quality supplied to agricultural lands off-tract. This would be done at the Detailed Development Plan stage.

**72. GEOLOGY** - Resource recovery (23). Possible recovery rates depend on room and pillar configurations, which in turn are dependent on rock compressive strengths, overburden pressures and allowable subsidence. While it is true that little work has been done at depth it is safe to assume that given the conditions found in the center of the Basin, recoveries of oil shale resources and associated minerals will not exceed those projected utilizing the Bureau of Mines pillar configuration. In fact, recoveries may be somewhat less due to increased overburden pressures requiring larger pillar configurations.

**73. LEASE** (23). The referenced statement should not be construed to include microfractures.

**74. LEASE** (23). The referenced statement does not contradict existing law, it only restates it. There is no reason to remove it.

**75. LEASE** (23, 48). This is accepted practice for all mineral leases issued by the Department of Interior. It does not expand the authority of the Secretary of Interior beyond what is already conferred upon him by law.

**76. LEASE** - Environmental Stipulations (23). Requirements for all containments of all slurries are the same.

**77. LEASE** - Socioeconomic stipulation (27, 28, 38, 46, M, G). The socioeconomic stipulation has been rewritten, and expanded to include offsite transportation impacts. The revised stipulation requires the lessee to consult with affected state and local government agencies in determining the specific contents of the socioeconomic and transportation report, as well as planning for and mitigating social, economic, and transportation impacts. See Section 15 of the Environmental Stipulations of the lease.

**78. LEASE** (27, 31, 33, 38, D, M, G). The suggested change has been added to the lease under Section 2(b).

**79. AIR QUALITY** - Model assumptions (29, 40, 48, 49, 53, G). The specific reasoning for selecting assumptions appears in the impact analysis technical report (Dietrich et al 1982a). The technical report also contains comparisons with commonly used EPA models such as COMPLEX II.

The dispersion parameters selected are those generally used by EPA to model in complex terrain. A more complete meteorologic data base is desired to reduce the uncertainties in the dispersion model analysis. Unfortunately no long-term monitoring of all the required parameters has been conducted in the area of interest.

**80. AIR QUALITY** - Model assumptions (29, 39, 44, 50, G). For pollutants to reach PSD Class I areas, transport of 50-200km is necessary. Conditions likely to cause the highest level of pollutants at these sensitive receptors would include light, persistent winds under moderately stable to stable conditions with moderate mixing depth.

The modeling approach did not include drainage winds because it is not currently possible to adequately predict these conditions in the area of study, nor is site-specific modeling commensurate with the regional transport analysis approach. Regarding the "accumulation episodes", a regional build-up situation was addressed in the impact analysis technical report (Dietrich et al 1982a).

Twenty-four hour stability was selected to represent "worst-case" conditions, but the Final EIS also considers a less conservative condition of 10 hour persistence for meteorologic assumptions as measured in the Piceance Basin. These extremes are presented as predicted concentration ranges.

Surface temperature fields were specified as being dependent on terrain height in a climatalogically acceptable manner.

"Class E" stability should be sufficient for limiting vertical dispersion under the mixing depth assumed. An excessively high mixing height will allow excessive dispersion but equally critical, too low of a mixing height will isolate elevated plume sources from reaching the ground. Plume rise must also be selected to minimize dispersion prior to transport, but also avoid undue proximate impacts.

Diurnally varying mixing depth box model calculations indicated the modeling approach as applied would provide higher predicted concentrations, and was therefore, "worst-case" (Dietrich et al 1982a).

**81. AIR QUALITY** - Model assumptions (29, 47, 52). Due to the preliminary nature of the proposed action (detailed information is non-existant), NEPA requires that a worst-case analysis be performed (40 CFR 1502.22). This method is admittedly conservative. As more site specific information becomes available, more specific analyses can be made.

**82. AIR QUALITY** - Polutant concentrations (29, 44, 50). Presentation of ranges for likely pollutant concentrations and additional consideration of mathematical accuracy have been incorporated into the EIS. Descriptions of how presentations were

derived appear in the supplemental impact analysis technical report (Dietrich et al 1982b).

**83. AIR QUALITY** - Impact analysis (29, 39, 45, 47, 49). Although the difference between the predicted short-term $NO_x$ value and the long-term $NO_2$ standard was recognized in the EIS, only a general comparison was intended. Rudimentary comparisons may be made by factoring in the $NO_x$to $NO_2$ conversion efficiency and an estimated ratio of short-term to long-term concentrations; 24 hour $NO_x$ values are expected to be 5 to 35 times higher than the annual $NO_2$ average concentration. The procedure for determining this empirical relationship is detailed in the supplemental impact analysis technical report (Dietrich et al 1982b). Based on the predicted ground level 24-hour concentrations for $NO_x$ reported in the Final EIS, violation of the annual $NO_2$ standard is not likely. It should be remembered that the relative magnitude of short-term $NO_x$ values is more important than its actual value in terms of $NO_2$. The EPA is currently considering developing a short-term $NO_2$ standard (Colorado Department of Health 1982a).

**84. AIR QUALITY** - Model assumption (29, 39, 47). The 24 hour persistent wind assumption was selected by analyzing a year of hourly wind patterns generated for the Uinta Basin Synfuels Draft EIS and concluding such persistence is indeed possible. The 10 hour wind persistence is likely based on data collected in the Piceance Basin. Taking this into consideration, the Final EIS contains ranges of concentrations assuming fixed 10 to 24 hour wind patterns.

**85. AIR QUALITY** - Model (29, 39). As described in the air quality impact analysis technical report (Dietrich et al 1982a), short-term standards are more conservative when compared to typical observed concentrations and therefore are the most easily consumed (the 24 hour increments can be consumed when annual averages range from a likely maximum just equal to, or as low as one-tenth of the 24 hour increment). Because of this sensitivity, a worst-case screening approach was used to evaluate the likelihood of exceeding the most stringent and constraining standards.

With respect to total deposition, the analysis performed represents a more conservative approach while remaining scientifically defensible. Sufficient data are not available to warrant inclusion of specific deposition velocities; worst-case assumptions were adopted instead.

**86. AIR QUALITY** - Total suspended particulates (29, 44). Total suspended particulates are comprised of "natural" emissions (wind blown dust, forest fires, etc.) and mechanical/combustion processes (rock crushing, woodstoves, etc.). We agree that fugitive dust (primarily wind blown) comprised of relatively large particles with a greater proportion of mass to size (having greater effect on mass standards), deposit out of the air rapidly, and present little health threat. Fine particulates (primarily combustion emissions) remain in the air longer, can be trapped in the lungs and are therefore a health concern and also degrade atmospheric visibility. Project specific emission values have been separated into ground level and process stack categories in the Final EIS. This breakdown primarily separates fugitive dust from combustion particulates.

**87. AIR QUALITY** - Model (29). The analysis is state-of-the-art in regional scale, complex terrain modeling. Indeed there is large uncertainty associated with any modeling analysis in complex topography especially one which carries the analysis out to 200km from over 20 sources whose detailed emission characteristics can only be speculated. However, a model was used which accounts for wind variation in complex terrain and is of a similar generic type of a model (MESOPUFF) recommended by EPA (albeit only for that specific situation) for 50km plus distances. Hence, the best available predictive tools were used. Model results should be viewed as uncertain, however every effort was made to bracket the worst possible situation in a conservative analysis. Actual impacts would most likely be smaller than predicted and would be further defined in a regulatory analysis if performed. Ranges are provided to indicate the uncertain nature of the predictions.

**88. HYDROLOGY** - Groundwater (29, 45, 48). The aquifer system identified in the Draft EIS is not described as a simple two aquifer system with open vertical communication between aquifers. The system has been summarized into an upper and lower system separated by a relatively impermeable system, and an alluvial system. While more detailed information does exist for the groundwater system surrounding C-b, that is not the case of the potential lease tracts, thus assuming a multilayered system is premature. The data that does exist, show that there is actually not a great difference in salinity between the so called upper and lower aquifers. This indicates mixing of the two systems (Multi Mineral Corporation 1981). Clarifications have been made as appropriate in the text. See Taylor (1982) for estimates of ranges of conductivity in the Mahogany Zone and the hydrologic role of the Mahogany Zone.

**89. HYDROLOGY** - Groundwater (29). Using the mitigation measures identified in the Draft EIS the possibility of retorts flooding is reduced. The author was unable to obtain information subsequent to the referenced report however, a report entitled "Assessment and Control of Water Contamination Associated with Shale Oil Extraction and Processing"

(Wagner et al 1981), states that the evaluation of leachate composition from Occidental Oil Shale Inc. retort 3E at Logan Wash, Colorado indicates that several environmentally sensitive trace elements, potassium, lithium, fluoride, vanadium, lead, boron, molybdenum, selenium and arsenic are not rendered immobile by in-situ processing. The reactions and resulting quality of leachates must be considered with respect to individual chemistry, the alkalinity of natural waters, and the contact times. All of these variables vary through the Basin. Generalizations will not always be valid.

**90. HYDROLOGY** - Groundwater (29, 30). Using a 20 foot per year rate of water transport in the upper aquifer as stated in the Draft EIS, and dividing this into 5,280 feet (one mile), it would take 264 years for transport. This agrees with the commenter's statement "The measurement is far more likely to be on the order of hundreds of years per mile". Please refer to Fox (1980). The text has been changed to show how this number was derived.

**91. HYDROLOGY** - Groundwater (29, 48). While the modelers agree that open vertical communication between the main surface stream and the bedrock aquifer is not entirely correct, it is felt that the model is appropriate for the intent of the EIS. There have been numerous studies and field data collection efforts to support the aquifer contributions to stream flow. The potentiometric surfaces of both aquifers slope towards the two drainages in the Basin, seepage runs conducted by the USGS indicate groundwater contributions to stream flow. Refer to Week et al (1974), Weeks and Welder (1974) and Robson and Saulnier (1981).

**92. HYDROLOGY** - Groundwater (29). There is sufficient data to support the Draft EIS analysis and conclusions, and this information has been properly documented in the references. Most of the laboratory leaching studies conducted on spent shales use distilled water. Even the studies which have used groundwater from the Basin do not allow for enough contact time. The contact time between the leached water and the spent shale may be in the order of 1 to 10 years (Fox 1979). In addition there is insufficient data available concerning the groundwater resources of Tracts C-11 and C-18. Without detailed water quality and groundwater parameters for the lease tracts the exact interactions between spent shale leachates and the groundwater system is not possible, thus a worst case analysis is required.

**93. RECLAMATION** - Spent shale disposal (29, 45). Underground disposal of surface retorted shale is a viable alternative. Bloomfield and Stewart (1981) in their analysis of various combinations of conveyor, truck, pneumatic and hydraulic transport found the conveyor method most efficient. In addition, the approved Sodium Mine Plan found that backfilling of the mine with raw shale can occur after five years of surface storage (Multi Mineral Corporation 1981). Since the approved Sodium Mine Plan does not contain the mineral lease rights to oil shale, the additional handling of material makes the economics of backfilling even more critical to create a viable mining operation. Also other sodium mineral interests in the immediate area are planning as a part of their operations to backfill wastes utilizing a slurry method. For more information the reader should obtain a copy of the following reference:

Bureau of Mines. 1972. *An Economic Analysis of a White Nahcolite Installation in Colorado; Option I.* U.S. Department of Interior. Open File Report #31-72. Morgantown, West Virginia.

**94. SURFACE RECLAMATION** - Topsoil (29, 48). The statement is true; only 15 to 18 inches of topsoil may be available where surface disposal would occur. However, to obtain 24 inches of *suitable plant growth material* (as stated in the text) it was assumed to borrow soil from the deeper soil types including possible use of their subsoils for successful reclamation.

In addition see Chapter IV, Reclamation, Aboveground Shale Disposal, which discusses alternatives to the use of suitable subsoil excavated at the disposal sites. Therefore, this is not "scalping" soil from one area to use in another.

**95. WILDLIFE** - Human encroachment (29). Size limitations for restriction of human disturbance on critical deer winter range will be determined on a case-by-case basis. There is no one established limitation distance as it varies with terrain and vegetation. Refer to Response number 66 for additional information on situations where this stipulation would be applied.

**96. WILDLIFE** - Fencing (29). Deer-proof fences would not be considered in violation of this stipulation if fences are constructed with under or over passes to facilitate animal crossing.

**97. WILDLIFE** - Raptor nests (29, 45). Nest interference consists of any management action performed to protect and/or maintain raptor nest productivity that interferes with development or recovery operations.

It should be noted that the U.S. Fish and Wildlife Service commented on the exceptions listed for stipulations in the Draft EIS. Apparently these exceptions were proposed, but have not yet been approved. Therefore, these exceptions have been revised to reflect present raptor regulations.

Also, a typographical error was discovered in the legal description for the raptor buffer zone. This has also been corrected.

**98. WILDLIFE** - Habitat loss (29, 45, 48). This estimate was derived by summation of the total acreage (20,000 acres) of surface disturbance from all projects addressed in the No Action Alternative. Added to this figure was an estimate of additional acreage (16,000 acres) that would not be physically disturbed, but impacted from human encroachment resulting in a decline in habitat effectiveness. The methodology for calculating reductions in habitat effectiveness is described in the footnote for Table IV-14.

Mule deer population decline or carrying capacity loss was estimated by correlating acreage impacted to population density estimates.

It is a correct statement that not all 36,000 acres would be in a disturbed state at any one time. The data used were based on total surface disturbance acreage and could not be broken down to identify actual acreage disturbed at any one time. Nor was information available to determine reclamation and mitigation effects at lessening this impact.

**99. SURFACE RECLAMATION** - Revegetation (29). While it is true that these shrub species (mostly salt tolerant) can be established, it would require intensive leaching, irrigation, fertilizing and mulching as was done at the referenced sites. Such intensive management has not been proven or studied for economically feasible application on a commercial scale of development. In addition, other researchers still feel that "to date adequate plant establishment has not been achieved on surface-to-shale treatments... Other management options need to be implemented if a successful plant community is to become established directly on Paraho retorted shale" (Redente et al 1982).

**100. HYDROLOGY** - Mitigation (29, 50). Lining of impoundments prior to and after operations is decided on a case-by-case basis and is subject to the 30 CFR 231 regulations. This is addressed in Section 9, (C)(1) and (2) of the Environmental Stipulations of the lease.

**101. WILDLIFE** - Mitigation (29). Mitigation alternatives such as evaluating browse species and methodology for reclamation can not be accurately addressed or evaluated until a mine plan has been submitted describing specific development plans. Such efforts should be appropriately addressed in the Detailed Development Plan.

**102. WILDLIFE** - Mitigation (29). Oil Shale Lease Environmental Stipulation, Section 4, mandates that the lessee submit for approval to the Mining Supervisor of Minerals Management Service, as a part of the Detailed Development Plan, a habitat management plan to include habitat reclamation and mitigation objectives. These objectives would be jointly developed by the lessee, Minerals Management Service, Colorado Division of Wildlife, Fish and Wildlife Service, and the Bureau of Land Management and updated as necessary. The development of an "industrial association" as described in Chapter IV, Uncommitted Mitigation Measures, would improve coordination of projects.

**103. WILDLIFE** - Human encorachment (29). As stated in Chapter IV, Wildlife, Human Encroachment on Habitat, "the decline in habitat effectiveness depends upon quantity and location of disturbance, topography, and availability of adequate escape cover". An average buffer zone distance of 0.1 mile was derived by analyzing the factors listed above specifically for Tracts C-11 and C-18. Technically, this distance would vary with changes in topography and escape cover.

**104. RECREATION** - Hunting quality (29). True. However, the solitude factor in the immediate tract vicinity and along tract access roads would be degraded due to the addition of mine structures, noise, and number of employees in the area.

**105. WILDLIFE** - Mitigation (29). The proposal to establish an industrial association involving various companies and agencies is only in a speculative stage at the present time. Decisions on how to establish or operate a wildlife trust fund have not been determined, but should be decided upon by the association participants. The association participants would also provide input into the selection of mitigation projects. It would be recommended that all companies and agencies involved with habitat disturbance or wildlife management in the Piceance Basin participate and make contributions. Projects would not be limited to the Basin, but also in other areas where benefits can be derived.

**106. LEASE** - Diligence requirements (29, 37, 38, G). Several comments were received on the diligence requirements of the lease, some stating they were not strong enough, others saying they were too strict. This is a prototype program that involves the development of new technology that inherently involves some risks. As such, it is felt that the diligence requirements, including the bonus offsets and royalty credits, are appropriate for this program. Prudent management requires that diligence be shown to prevent speculation, while at the same time allowing for some flexibility. Disallowing bonus offsets or royalty credits would only reduce the amount of the bonus bid accordingly, thereby resulting in a net reduction in up front monies available to the State and local governments for impact mitigation.

**107. LEASE** - Retroactive effects (29). This action will not have any retroactive effect on any existing prototype leases.

**108. HYDROLOGY** - Groundwater (30). While it is believed that complete/perfect communication between the main surface stream and the bedrock aquifer is not entirely correct, it is felt that the model is appropriate for the purpose of the EIS. Presently there is limited data available to describe the groundwater system of Tracts C-11 and C-18. Groundwater quality data collected from wells in the area of the proposed lease tracts indicate that there is not a great difference in the salinity of the two aquifers. The 9,610 mg/l sample taken from the lower aquifer is misleading and a statement to that fact has been incorporated in the Final EIS. To substantiate this fact, a seven day pump test was conducted by Shell on the proposed C-18 tract with the maximum TDS being 1040 mg/l. This indicates that there is a cross-mixing of aquifers in the proposed lease tract areas. Chapter III, Hydrology, describes the aquifer involving three aquifers and a relatively impermeable zone (Mahogany Zone). While this is an oversimplification, information is not available to justify a more complex system.

**109. HYDROLOGY** - Surface water (32, 45). The four percent depletion of flows to the White River is an estimate of the water needed for consumptive use for oil shale development at a production rate of 100,000 bbl/day. If the water was obtained by either water table drawdown or tributaries leading to the White River, the impact would be the same. The text has been clarified.

**110. MINERAL ACTIVITY** - Worker safety; impacts of nuclear gas stimulation project (32, D). Direct mining would not occur in the leached zone, due to the poor rock stability (see Chapter IV, Geology, Extraction of Minerals from the Leached Zone), so worker safety would be maintained. Resource recovery in the leached zone, although not quantified, would probably be attempted by using a true in-situ methodology.

The nuclear blast may or may not have had an effect that would contribute to the poor mine conditions in the leached zone. Rio Blanco Gas Stimulation Project, Rio Blanco, Colorado, Environmental Impact Statement, Dept. of Energy, 1972, states that previous tests of underground nuclear blasts at Nevada test sites found little or no effect upon rock mechanics for mining areas beyond a 400 foot radius of the blast hole. That EIS further states that since the bottom of the oil shale-bearing strata in the Piceance Basin is 3,000 feet above the blast zone, no explosion-induced fractures would propagate that far.

Measurements have indicated that fracturing may have occurred as far north as Black Sulphur Creek which is 2.5 to 3 miles from the southern boundary of C-11. Any undetected fracturing would be manifested in the form of soluable radionucleides. The hydrology monitoring program conducted by EPA has yet to detect manmade radionucleides from the blast zone. The explosion's effects upon the continuity of the Mahogany Zone were tested in four wells located approximately 1,300 feet northwest of the blast well. Results of postdetonation pumping tests for aquifer communication across the Mahogany Zone were negative.

Gas produced from the blast well (RB-E-01) and the alternate re-entry well (RB-AR-2) contained contaminations of tritium, argon 37, krypton 85, small amounts of radon 222, cesium 137 and strontium 90. These wells were plugged and abandoned in July of 1977 due to insufficient quantities of gas produced. Contaminated test flow production water from the above wells was disposed into a third well (Fawn Creek Government well) and the disposal zone permanently sealed. The Fawn Creek Government well was originally a gas well and was recompleted (after water disposal operations) for gas. The gas contained no detectable amounts of tritium. However, the well does produce a small amount of water that is contaminated with tritium. The well was "shut in" in February, 1977 awaiting determination of final disposition of the gas producing zone.

**111. GEOLOGY** - Spent shale (32, 42, 46b, D). Spent shale disposal piles should be located to avoid dry local recharge areas, however actual pile location criteria would be discussed in more detail in the Detailed Development Plan once the lease is issued. In addition, the type of retorting and treatment the shale will undergo for processing could require alternative types of disposal pile designs and siting criteria. An addition to the text has been made concerning subsidence due to dewatering, mining and location of shale disposal piles.

**112. SURFACE RECLAMATION** - Cooling spent shale (32, D). A section on cooling spent shale has been added to Chapter IV, Surface Reclamation and Solid Waste Disposal.

**113. SURFACE RECLAMATION** - Raw shale (33, 46b, D). Commercial scale operations will most likely be dealing with a greater volume of spent shale as operations progress. Therefore, stockpiles of raw shale are likely to be less voluminous (unless ground into fine material) and thus have a lesser impact in relation to the spent shale disposal operations. This is the reason for having not added more information concerning leachates from raw shale.

**114. LEASE** - Discretion of Mining Supervisor (33, 37, 38, 48, D, G). Several commenters were

concerned about the Mining Supervisor's discretion in approving various portions of the lease requirements. It needs to be stressed that the Mining Supervisor does not make decisions alone. Minerals Management Service has an interdisciplinary team that reviews all decisions and actions taken on behalf of the Mining Supervisor; the State of Colorado participates in the process through the Regional Oil Shale Team and the Oil Shale Environmental Advisory Panel; and the BLM is involved in all decisions that affect their management authority on the lands involved as required by the Secretary of Interior Order Number 2948, dated October 6, 1972. For ease of communication, the Mining Supervisor has been identified as the single contact for the lessee to initiate all actions on the lease that require approval. Formal public hearings would be called for when a decision by the Mining Supervisor would be far-reaching, controversial, or not in the interest of good management of the lease. However, some discretion must be maintained by the Mining Supervisor in the management of the lease.

**115. FLOODPLAINS** (34, 48). The mitigation requirements of Executive Order 11988 have been addressed in Chapter IV, Floodplains. Further, site-specific mitigation will be designed in a Detailed Development Plan should tract leasing occur. Oil Shale Lease Environmental Stipulation Section 11(l) also pertains to protection of floodplains.

The methodology and criteria employed to assess flood hazards can be obtained by contacting the Army Corps of Engineers, Sacramento District, Sacramento, California. The addition of tables describing discharge values would not add to the content and results of this EIS.

**116. HYDROLOGY** - Surface flows (35). The pre-project monthly flows of Yellow and Piceance Creeks and the White River are available in the USGS Water Resource Data as described in the text. Post-project monthly flows are available at the BLM White River Resource Area Office from simulation runs using the Bureau of Reclamation Colorado River Simulation Systems model.

**117. HYDROLOGY** - Water rights (35). The statement includes both potential and actual agricultural uses. Because Colorado's water is governed by a pure appropriation system, water cannot be set aside for any one particular purpose as long as it is put to a beneficial use.

**118. ECONOMICS** - Revenues/expenses (36, 38, 48, 52, M, G). Impacts on community facilities and services were not estimated in the Draft EIS because sufficient data had not been acquired. That data is now available, and those estimates have been included in the Final EIS. These will be compared to estimates of the communities' ability to issue bonds as a measure of the fiscal problems that would result from this action. These costs are the most significant fiscal impacts that local government would incur, and usually cannot be funded wholly from local sources. It is felt that estimating annual operating expenses would not significantly add to the analysis. Under these circumstances, separate estimates of annual revenues should perhaps be omitted; however, they are routinely requested by local officials and BLM decision-makers and have therefore been provided.

**119. LEASE** - Royalties (37, 38, 48, G). Some changes have been made to clarify the language in Section 7, Royalties in the lease. The royalties to be paid for oil shale will in fact increase, since they are tied to the Producer's Price Index. Also note that this increases the minimum royalty rate.

For example, if the royalty were to be applied to production in October 1982, the Producer's Price Index for September 1982 of 718.8 which when divided by the March 1974 index of 201.7, would result in an escalation factor of 3.56 being applied to each of the royalty rate amounts. This would result in a basic royalty rate on the October 1982 production of 42.8 cents per ton of oil shale for oil shale processed either through mining or in-situ methods with a reduction or addition of 3.6 cents per ton for each gallon of shale oil per ton above or below the 30 gallon average, and a minimum royalty rate of 14.3 cents per ton.

Tying the royalty rate to cents per ton rather than as a percentage of the value of the oil produced is simple to compute and, since it is adjusted by an escalation factor based on the Producer's Price Index for crude petroleum, it fairly reflects the relative value of the end product.

The text has been changed to include royalty rates and total royalty revenues based on the September 1982 index (see Chapter IV, Economics).

**120. LEASE** - Baseline monitoring (37). Monitoring is an ongoing process that continues prior to, during and after development. Existing data may also be used to supplement baseline monitoring. Current provisions in the lease for baseline monitoring are felt to be reasonable.

**121. SURFACE RECLAMATION** - Monitoring (37, 38, G). The length of time of environmental monitoring following abandonment will be determined when abandonment is contemplated. Abandonment plan approval would be contingent upon establishment of a reasonable timetable for continued environmental monitoring. The length of time is determined by the estimated period it will take to reclaim the resources affected, based upon the knowledge of the reclaimability of those resources at that time. The lessee is responsible for environ-

mental problems related to reclamation from the time of cessation of mining until the reclamation bond is returned to the lessee, as described in Section 9, Bond, in the lease. Clarification has been added to the text.

**122. LEASE** - Surface reclamation (37). The language "consistent with or equal to" is intentionally used to allow for rehabilitation to different land use than pre-leasing. The language of this section has been changed to "consistent with or equal to" in both places where it occurs.

**123. GENERAL** - Scope (37, G). This is beyond the scope of this EIS.

**124. ECONOMICS** - Mitigation (38, 44, 47, M, G). Analysis of potential housing impacts is provided in the EIS because local private financial resources would clearly be inadequate to satisfy projected housing and other capital needs. Provision of such financing would depend on the policies of the oil shale industry and private financial institutions.

In order to avoid intervening in local government activities any more than is necessary, BLM's policy is not to include stipulations in its leases imposing financial contributions or other types of social and economic mitigation requirements on the lessee. County permitting authority has been used successfully for that purpose in Colorado.

Assessing the responsibility of private financial institutions is beyond the scope of this document.

It should also be noted that 50 percent of lease royalties, bonus bids paid and other mineral-related federal revenues are returned to the state for the purpose of social and economic impact mitigation, and the state passes these revenues on to impacted counties and communities.

An addition has been made to the text in Chapter IV, Uncommited Mitigation Section to clarify these points.

**125. GENERAL** - Alternative Tracts (38, D). Several alternative tracts were offered for expressions of interest by industry. The tracts offered were distributed throughout the Saline Zone and were amenable to development of oil shale concurrently with associated minerals. However, industry only expressed primary interest in C-11 and C-18, thereby limiting the analysis of the EIS. Little purpose would be served in analyzing tracts in which no interest had been shown for development. These tracts meet the Department of Interior's intent to offer lease tracts with potential for development of oil shale concurrently with associated minerals and the objectives of the prototype program.

**126. LAND USE PLANNING** (38). The Management Framework Plan was not intended to be a detailed environmental impact assessment, but a decision document on managing the public lands in the White River Resource Area. This EIS provides the environmental analysis the commenter feels is lacking in the MFP.

**127. GEOLOGY** - Open pit mining (38, 48). It is true that a large migrating open pit could theoretically recover a much larger portion of the oil shale resources than simple room and pillar mining, but it is not within the scope of this EIS to discuss or attempt to determine what, if any, methods may be utilized in the distant future to recover apparently lost resources.

Open pit mining was not fully analyzed as a Development Scenario because it is unlikely to occur on either tract as discussed in Chapter IV, Geology and Mineral Activity, Surface Mine Impacts.

**128. TRACT SELECTION** (38). The objectives of the Prototype Oil Shale Leasing Program are the tract selection criteria. A more formalized tract selection process will be developed for the Department's long-term, commercial oil shale program.

**129. SOCIOECONOMICS** (38). Briscoe, Maphis, Murray and Lamont, Inc.'s Socioeconomic Assessment and the Garfield County Human Service Plan provide thorough coverage of that part of the impacted area, although some questions can be raised about the methods used in the latter study. However, data from these studies, particularly on community facilities and services, have been incorporated into the Final EIS.

**130. SOCIAL** - Impact analysis (36, 38, 44, 47, 48, 49, 52, M, G). The trend in social impact analysis in recent years has been to include more and more detailed current socioeconomic indicator data (such as on facilities and services) as if this procedure constitutes social impact analysis. (It does not. Social impacts include such components as are outlined and discussed in Table IV-18.) Of course, in many cases socioeconomic data are important to the purposes for which an analysis is made. Most especially such information is used by a community for planning financial mitigations for negative impacts. Some discussion of the individual community facilities expected to be most severely affected by this EIS program has been properly included in Chapter IV, Economics.

However, almost all communities (and counties) at all times have money problems. Sufficient funding never exists for building extra capacities into all facilities (streets, sewers, water) and services (police and fire, mental health, education) for far into the future. Thus, almost every town may have excess capacity in one or two areas of need and little or none in the rest. Boom growth will find one community with a recently built new school having extra classrooms, but with need for a new sewer

system; another community will have a new sewer system with excess capacity, but an inadequate hospital; and so on. Boom growth will generally fill up all the "excess space" wherever it may be, and overload those components already full. The overall financial picture will be similar, though details may differ among communities. For decision documents such as this EIS, such data are of limited value; for social analysis, they serve virtually no purpose except as their social implications can be traced; and these depend primarily upon the numbers of new people coming in, the rates at which they enter and leave, and their characteristics relative to the host population. These latter factors are more important for social analysis than are the socioeconomic indicators, for several reasons.

First, the lag time between preparation of an EIS and the time social impacts other than financial preparation are scheduled to occur is sufficiently long that even finely tuned present data will have become largely obsolete.

Second, even though some community social structures may be more capable than others of absorbing numbers of people, nevertheless, as noted above, levels of "overload" tend to be fairly consistent in all services and facilities for a community. It is unlikely, for instance, that drastic social impacts would occur upon the school system while the mental health and police departments were experiencing only insignificant impacts.

Third, severity of impacts is directly correlated with annual growth rates upon initial size of community. In fact, studies of energy boom towns have demonstrated that this is the single best predictor we currently have of social impacts.

For improving social impact predictions we need better information on such things as characteristics of the incoming work force compared with the local, residents schedules of in-and-out transiency for construction workers, and the degree of local "readiness to accept" the new people (dependent upon social-historical rather than purely historical information).

While financial problems are often predictable with some accuracy, no standardized definitions exist for what constitutes severe social impacts, nor do researchers agree upon the rate of annual population increase associated with the term "severe". Judgements range from five to fifteen percent annual growth at the "severe" level. In any case it will vary according to the factors just mentioned.

Unfortunately, except for a limited study of construction workers several years ago (Mountain West 1975), no reliable data on pertinent work force characteristics are available--these have proven very difficult to obtain, though a clearer picture is beginning to emerge. Especially for construction workers, these data would be important. Objective measures of community "readiness" are lacking, and readiness constantly changes for individual communities. We can say that in recent times communities in the path of energy development have been able to benefit from experiences of prior boom towns and are generally better prepared; also energy companies are picking up some responsibility for ameliorative measures. The Garfield County 1982 Human Service Plan is a notable example of advance area planning.

Thus the severity of negative social impacts is reducible to the extent that planning can be done around advance knowledge of rates of influx, in-and-out turnover (construction) or permanence (operations) of workers, the needs and interests they will bring, the degree to which these will be compatible with and acceptable to present citizens, and the extent to which time and funds are available for advance financial preparations, for needs defined by a given community.

There are, of course, social implications in such things as housing shortages, school overcrowding, and insufficient alcohol treatment and mental health services, and these could be considered. Such impacts would be generally similar, for a given shortage, across communities.

Percentages shown at top of Table IV-20 reflect our own best judgments regarding relative overall severity of social impacts among the various communities, taking into account their levels of readiness and preparation as we can evaluate these. (Chapter III discusses readiness of the communities involved.) Comparisons among communities remain the same relative to each other.

We should emphasize once more that since the EIS precedes the lease decision and is part of that process, its primary purpose is to estimate levels and directions of social impacts, not to evaluate the details and problem areas for specific communities which those communities would need for planning and preparation.

To summarize, it benefits communities to know themselves and to decide just what social structural elements will be changed, what facilities will need modification, what social services will need to be expanded or added, and what ways are available to pay for these things. The Federal government helps with these through available funds, etc. (see Chapter IV, Social and Economic mitigation section for discussion of these.) But it is not the Federal government's function to provide needs assessment data, only to provide the best possible predictions of growth so that communities may assess their own needs.

**131. ECONOMICS** - Manpower needs (38, M). Estimates of manpower needs for the alternatives are based on data collected by the Colorado Department of Natural Resources on other oil shale projects in that area. Given that the tract developments are hypothetical, and that construction schedules of these and other projects are uncertain enough that the future labor supply at any point in time is essentially unpredictable, manpower needs must be estimated generically based on data and projections for similar projects. Therefore, these uncertainties would cause a detailed skill analysis of the labor force to give a wholly false impression of accuracy.

**132. SOCIOECONOMICS** - Mitigation (38). Requiring specific methodologies for socioeconomic impact assessment is inappropriate for the lease stipulations. The EIS used the most recent publicly available data from the Cumulative Impact Task Force (CITF) - see Response number 36.

**133. SOCIOECONOMICS** - Mitigation (38, G). The 50 percent of the bonus payments being returned to the State of Colorado is a form of prepayment for front end socioeconomic mitigation costs since payment begins prior to actual development activity on the lease tracts. If the State makes these monies available to local governments for this purpose, requiring advance royalty payments would be unnecessary.

**134. GEOLOGY** - Gassy mine conditions (38, D). A section on gassy mine conditions has been added to Chapter IV, Geology and Mineral Activity.

**135. HYDROLOGY** - Model (38, 44, 47, 48, 50). The model used for the determination of groundwater impacts resulting from dewatering operations is sufficient for the purposes of this EIS. The potential lease tracts C-11 and C-18 do not have the wealth of hydrologic data that existing leases C-a and C-b have. Because of this, a site-specific model would have to utilize average Basin wide input parameters for modeling purposes. In addition, site-specific models must assume some kind of boundary condition. Hydrologic impacts do not end at this boundary.

A regionalized model examines Basin wide impacts, which is of importance to any Environmental Analysis. Existing modeling inputs and assumptions can be found in Taylor (1982). Model limitations are identified in the text.

**136. WILDLIFE** - Impact analysis; stipulations (38). It would be difficult and inaccurate to attempt estimating what the actual reductions in carrying capacity would be with existing information from these impacts. Toxic uptake by vegetation, effects on springs, and revegetation of browse and cover on spent shale piles have been discussed to the extent possible in this EIS. These impacts, however, must be further addressed with adequate mitigation developed in the Habitat Management Plan required by Oil Shale Environmental Lease Stipulation 4(b).

Discussion with Minerals Management Service indicates that Oil Shale Environmental Lease Stipulation Sections 4(B) and 9 do provide an adequate basis for mitigating aquatic and other habitats.

**137. SURFACE RECLAMATION** - Monitoring (38). Changes have been made in the text to help clarify this concern. We are not able to accurately assess what will take place in several hundred years should spent shale be exposed at the surface. This is because the composition of the waste material is uncertain and the effects of weathering of this material are unknown. It is possible that spent shale could become soil parent material. A soil derived naturally from such a material could have zones of salt and clay accumulation and could be high in clay overall. Such a soil would be similar to Natrargids which occur in various locations in the Piceance Basin. These present day soils support stands of greasewood, shadscale, fourwing saltbush, western wheatgrass and other fairly salt tolerant plants. It must be kept in mind that this discussion is speculative. Making predictions of what will happen several hundred years from now is an uncertainty.

**138. LEASE** - Alternative control technologies (38, 39, D, G). A detailed analysis of the alternative control technologies available for air and water pollution is not within the scope of this document. The lease requires compliance with all existing state and Federal standards. At the time of submission of a Detailed Development Plan, the lessee would have to demonstrate compliance with these standards to the satisfaction of the Mining Supervisor. The Environmental Stipulations of the lease (Section 1(B)) provide for an annual review of technology advances and the need for amending existing stipulations to make activities "as free from environmental damage as is practicable. Toward this end, systems which require pollution control devices shall possess sufficient flexibility to adopt improved technology at practicable intervals and shall be constructed with the understanding that continued compliance with changing pollution control laws is required".

The purpose of these and other provisions of the lease are clearly to require the lessee to provide for the protection of the environment through advanced pollution control technology. To examine all technological options currently available, without knowing the development process to be used, would be excessively burdensome, would serve no useful purpose at this time, and is outside the

scope of the EIS. It is felt that the decision to lease can be made with the information provided in this document.

**139. AIR QUALITY** - Scope (39). These elements were not considered in the current EIS due to a lack of necessary data concerning specific siting, on-site meteorologic data, proposed processes and control technologies. Worst-case analysis and qualitative comparison of lease tract options were utilized instead.

**140. AIR QUALITY** - Visibility (39, 44, 49, 50). Level 1 visibility analysis provides an adequate indication of possible "worst-case" visibility impairment. Emission characteristics (i.e., source parameters) are not specified in sufficient detail to warrant higher level analysis. Detailed, less conservative analysis, would be addressed in a site specific EIS and for permitting purposes. The current state of knowledge and available data are not sufficient to project regional haze estimates.

**141. AIR QUALITY** - Ozone; hazardous pollutants (39, 45). We are unaware of any technique which could be used for projecting ozone impacts other than the method used in the referenced analysis. This is supported by the fact that the contractor who performed that analysis, is the developer of virtually all of the ozone analyses currently in use. Thus, their choice to use EKMA, admittedly developed and validated for urban areas, is made on the basis of extensive experience and scientific expertise. In examining the results of their analysis no substantively different results would be obtained if additional computations would be performed. Referral to their analysis provides the necessary scientific integrity.

Information currently available does not suggest any significant impacts associated with carbon monoxide or hazardous pollutants (such as heavy metals or radioactive compounds) from oil shale development. Due to the limited development of oil shale technologies, little data are available regarding release of hazardous pollutants. Studies are continuing which will supplement the preliminary analyses. Further discussion of these pollutants is included in the supplemental impact analysis technical report (Dietrich et al. 1982b).

**142. AIR QUALITY** - Ozone (39). The "exceedances" are first maximum hourly averages and do not represent ozone standard violations. The following discussion appeared in Volume 2 of the 1981 C-b Annual Report (Cathedral Bluffs Shale Oil Company 1982):

"Ozone is the only (gaseous pollutant) monitored consistently having a measurable mean concentration. Also, in the past it has closely approached the ambient air standard, this behavior is of interest because there are no development-related emissions of the type and magnitude to cause elevated ozone levels..."

"Since ozone is the product of (photochemical) reactions and also present in the stratosphere rather than an emitted substance, its concentration is subject to variations due to stratospheric down mixing or to changes in the intensity of isolation, providing the driving force of ozone-producing reactions. This results in a seasonal pattern ... with the highest mean concentrations in summer, ... and lowest in winter. Over the history of ozone monitoring on-tract this seasonal pattern coupled with the large random component has been consistently present."

The EIS did not intend to "dismiss" this situation, but to indicate the lack of knowledge regarding elevated ozone concentrations.

**143. AIR QUALITY** - Model (39, D, G). Worst-case situations are well known and easily established with regard to simple, straight-line Gaussian models from individual sources. When multiple sources are considered, worst-case situations become less obvious. Adding a complex topographic environment makes identification of the absolute case extremely difficult. The modeling approach applied considered the following when determining the worst-case scenario:

1. Spatial meteorologic patterns.
2. Temporal meteorologic patterns.
3. Relationship of the source distribution to meteorologic patterns.
4. The likelihood of the meteorologic patterns.

Plume trajectories for both potential prototype lease tracts were modeled through all eight cardinal wind directions (plus west-southwest because of its historic wind dominance). The west-southwest wind scenario predicted the highest impacts to PSD Class I area (Flat Tops Wilderness) due to the combined emissions, and was considered to be the "worst-case" situation. Prototype impacts to Dinosaur National Monument and Mount Zirkel Wilderness were also modeled. The screening analysis indicated a low probability of direct impacts to the TSP non-attainment area, Colorado National Monument and towards Arches National Park. Due to its higher elevation and geological sensitivity, the Flat Tops Wilderness is believed to be more sensitive to acid deposition than the surrounding areas.

**144. AIR QUALITY** - Wind (39, 44, 47, 48, 49, 50, 52). Although not a frequent occurrence, Systems Applications, Inc. (1982) analysis of actual meteorologic data suggest 24 hour wind persistance is not an unrealistic assumption, and indeed

worst-case. Temporal wind patterns are not directly accounted for, but local flows probably do not exert a profound influence on a regional scale under worst-case conditions. If a stable period were to persist for a few days, local scale accumulation would override regional impacts. Worst-case trajectories are, by definition, relative to the receptor, and in this analysis several wind fields were compared to determine which was most likely to impact a PSD Class I area. Twenty-four hour persistance of areas of convergence are unlikely - the modeling approach has been refined accordingly.

**145. AIR QUALITY** - Modeling (39). The modeling performed allowed consideration of TSP, $SO_2$ and $NO_x$ impacts in a specific manner. Sufficient scientific data are not available to warrant inclusion of details such as separate reaction rates for $SO_2$ or $NO_x$, nor deposition velocities for $SO_2$ or $NO_x$. Worst-case assumptions were adopted in order to make conservative estimates, as required in NEPA (40 CFR 1502.22).

The rate at which several projects proceed will vary and cause a commensurate variation in air quality impacts. The modeling approach assumed the projects would have developed up to the designated production level by 1993 and 2003. It is not reasonable to expect predictions of yearly or biyearly emission variations over twenty years for technologies which are speculative.

**146. AIR QUALITY** - Emissions (39, 40, 53). The emissions inventory has been revised and is listed in the Final EIS along with plant location, elevation, production level and operating process. The primary source of Colorado oil shale emissions is the Colorado Department of Health - Air Pollution Control Division (Lauderdale 1982). The stack parameter data used to separate ground sources from elevated stack sources came from Pedco Environmental, Inc., (1982) as did emission values for the Rio Blanco and Superior-Pacific Processes. Chevron mining/retort operations and upgrading facility emissions, and general plume rise values came from the respective PSD permit applications (Verstuyft 1982). All Utah source emissions data came from the Draft Unita Basin Synfuels Development Air Quality Technical Report (Systems Applications, Inc. 1982). Colorado power plant emissions were calculated from applicable source performance standards (Frey 1982) and reported coal usage/heat content (Ladwig 1982).

**147. AIR QUALITY** - Model (39). The recommended procedure referred to: (a) is solely to "resolve the local winds"; (b) was provided prior to extensive experience with WINDS model applications; and (c) additionally states that "non-model dependent factors (terrain complexity and computer resources) must be considered in selecting the grid interval" (Fosberg et al. 1976). Sensitivity studies were conducted (as the commenter suggests) which indicated little sensitivity of plume paths to smaller grid spacing. Large spacing leads to a less refined wind pattern and hence straighter plumes. The end point of no wind variation would simulate conventional Gaussian model assumptions. "Realistic plume trajectories" is a matter of judgment. The grid spacing was selected based on examination of the topography in the vicinity of the sources, for example, insuring that the elevation of sources were correct, that major topographic features were resolved, as well as a study of the wind fields simulated. The grid spacing selected is proper in resolving major topographic influences on the winds. (Wind flow diagrams are available in the supplemental impact analysis technical report; Dietrich et al. 1982b).

**148. GENERAL** - Assumptions (40). The sequence and method of extraction of oil shale, nahcolite and dawsonite for each Development Scenario that was assumed for purposes of the analysis is described in Chapter II, Description of the Alternatives.

**149. GENERAL** - Terminology (40, 45). This contradicts information originally provided by the Minerals Management Service, therefore, no change to the text has been made.

**150. HYDROLOGY** (40). Figure III-11 is used only to give the reader the general relationship of the two water bearing structures of the Basin. The general orientation of the figure is East-West as indicated in the figure. The cross section does not cross Yellow Creek.

**151. GENERAL** - Assumptions (42, 50). For purposes of this analysis, the development technology assumed for both C-a and C-b is a modified in-situ process.

**152. HYDROLOGY** - Water requirements (42, 50). These figures for C-a and C-b are in agreement with the range of water requirements provided by the Minerals Management Service who have been monitoring those tracts. The predicted water requirements for C-11 and C-18 are within this range. As stated in the text, these figures can vary widely, depending on the process used.

**153. HYDROLOGY** - Data source (42, 46b). The White River station near Ouray, Utah was selected for the following reasons:

1. This station is the closest point in the Bureau of Reclamation Colorado Simulation System Model to the Basin, because the White River Dam replaced the Utah-Colorado station.

2. There is minimal inflow between the White River near the Utah-Colorado Stateline Station and the White River near Ouray Station.

For further information, see the reference sites in the Draft EIS for Bureau of Reclamation simulation model.

**154. SOLID WASTE DISPOSAL** - In-situ spent shale (42). Discussion of in-situ spent shale is not included due to the lack of public data currently available. Although research and information has been gathered, discussion with researchers whose work deals with spent shale disposal sites (DOE; Laramie Energy Technology Center; U.S. Army Engineer Waterways Experiment Station, Geotechnical Lab; and D'Appolonia Consulting Engineers Inc.) indicate that this information is proprietary and available only to the companies who have directly conducted research in this area. At the time of detailed development plan preparation and approval, efforts should be made to obtain this data.

**155. GENERAL**. The commenter has misinterpreted the referenced statement, and is encouraged to reread it. The text is self-explanatory.

**156. GENERAL** (42, 45, 48, 49, M). The referenced statement in the text has been verified, and is correct as shown. No change to the text has been made.

**157. SURFACE RECLAMATION** - Compaction (42). Although compaction on a large scale has been performed using conventional equipment, it has not been conducted on a large scale commercial operation. No change to the text has been made.

**158. SURFACE RECLAMATION** - Scope (42). This EIS is adequate for the decisions and commitments to be made at this time. Specific impacts caused by disposal, volatilization from pile surface, microbial transformation of metals to toxic compounds and construction impacts will be identified and analyzed in more detail when the Detailed Development Plan is submitted by a lessee.

**159. SURFACE RECLAMATION** - Revegetation (42). Discussion with the principal authority of the two publications you cited indicates that this section is adequate for the purposes for which it was written.

**160. HYDROLOGY** - Model (42, 48). The model assumptions are outlined in Taylor (1982). The low hydraulic conductivity will lead to rapid recovery, not slow as stated in the comment. The text has been changed for clarification.

**161. HYDROLOGY** - Assumptions (42). The No Action Alternative states that C-a and C-b will be developed. C-a was assumed to be developed at two scenario's 50,000 bbls/day and 100,000 bbls/day, C-b scenario's were 21,000 bbls/day and 76,000 bbls/day. For any development to take place both tracts will have to be dewatered. Robson and Saulnier (1981) simulate dewatering of both these tracts and the water quality impacts associated with them. The impacts to the White River were determined using the Bureau of Reclamation's Colorado River Simulation System model. While the same model was not used for development and No Action Alternatives, both models are regional models and a comparison is valid.

**162. GEOLOGY** - Resource recovery (45). The sentence immediately following the referenced statement clarifies this comment.

**163. SURFACE RECLAMATION** - Revegetation (45). Most research has shown that gentle slopes and northern exposures are always easier to reclaim than the more xeric south facing slopes in arid climates.

**164. GENERAL** (45). The Minerals Management Service, Oil Shale Office in Grand Junction was consulted for clarification on this comment. It was determined that no change to the text of the Final EIS is necessary.

**165. HYDROLOGY** - Surface flows (45). Piceance Creek as measured at the White River according to the USGS Water Resources Division has never experienced periods of no flow. The least amount on record was 0.5 cubic feet per second measured on July 21 and 22, 1966.

**166. TRANSPORTATION** - Alternatives (45). Pipeline transportation alternatives have not been addressed, since such speculation is felt to be beyond the scope of this EIS. This has been stated at several places in the document. The desirability of alternate product transportation modes has been identified.

**167. GENERAL**. Further clarification is unnecessary as it would not substantively change the analysis.

**168. GENERAL** - Format (45). No ranking was intended or suggested.

**169. GENERAL** (45). The general location of the Bureau of Mines Horse Draw facility is correct as shown.

**170. GEOLOGY** - Oil and gas conflicts (45). Chapter IV, Geology and Mineral Activity describes in detail the impacts of oil and gas activities on oil shale for the No Action Alternative. The portion which you referenced as needing more clarification is the Description of the No Action Alternative section. The wording of "temporarily prevent extraction of ... oil shale ..." implies that the oil shale could

still be recovered eventually regardless of whether the oil and gas was subordinated to oil shale.

171. **SURFACE RECLAMATION** - Revegetation (45). The comment "soil losses depend upon the degree of reclamation success" is an accurate statement. Also, 100 percent mitigation of AUMs is *not* a certainty, but appears to be a realistic projection for the No Action Alternative. These two statements appear contradictive unless the time period factor required for vegetation replacement is applied. Specifically, soil erosion potential may be greatest during the time it takes for vegetation to become reestablished on disturbed sites.

172. **AGRICULTURAL LANDS** (45). Refer to Chapter IV, Agricultural Lands for definition of agricultural lands, cropland, rangeland and woodland.

173. **TRANSPORTATION** (45). Impacts to transportation, including employee transportation, are discussed in greater detail under Chapter IV, Transportation.

174. **LAND USE PLANNING** (45, G). The proposed action, offering one or two additional tracts under the prototype program, is consistent with the Management Framework Plan (MFP) for the White River Resource Area, as stated in Chapter I, Relationship to Other Documents, (3). The Resource Management Plan for the Piceance Basin, currently being prepared, will identify areas for future long-term, commercial oil shale development, and will supercede the MFP decisions for the Piceance Basin.

175. **VEGETATION** (45). The herbage production levels used in the text appear significantly greater than the data based on C-a and C-b studies. Close examination shows both C-a and C-b figures are for *forage* production, whereas the EIS figures are for *herbage* production. This is the apparent reason for the variance.

176. **SOLID WASTE DISPOSAL** - Backfilling (45). Mine voids could be filled to full height if the mined areas are developed on a slight slope similar to that of the once proposed Superior mine design. Mine workings used as haulage ways would only temporarily be kept from backfilling operations. Concerning the economics of backfilling, refer to Response number 93. This leaves only the expansion factor which would require surface disposal.

177. **SURFACE RECLAMATION** - Spent shale (45). Concerning leaching of commercial volumes of spent shale to reduce pH, the reader is directed to the last sentence of the paragraph in question. Capillary barriers are also discussed in Chapter IV, Surface Reclamation, Aboveground Shale Disposal.

178. **SURFACE RECLAMATION** - Surface disturbance (45). As stated in the text the reduction of the surface disturbance is dependent upon "the sequencing" of final retorting, mine facility withdrawal and the stockpiling of spent shale for a short period of time while the facilities are being decommissioned.

179. **GEOLOGY** - Stratigraphy (45). On page two of the Multi Mineral Mine Plan it states the "mining horizon" (Love bed) consists of a sequences of bedded nahcolite and nahcolitic oil shale. On page 41, second paragraph of the same mine plan, the Love bed is described as "not a single zone" but five individual nahcolite seams interstratified with four beds of nahcolitic oil shale. Therefore, they are referred to as several zones in this EIS.

180. **SURFACE RECLAMATION** - Erosion (45). The source and quantities of soil like material to be used in reclamation is described in Chapter IV, Surface Reclamation, Aboveground Shale Disposal. Loss of 50 percent of the soil material is based on a worst case analysis and the estimated erosion rates of those soils. Concerning the slopes of spent shale for disposal, no mention is made of their slope design in this section. Please read Chapter IV, Surface Reclamation, Location of Shale Disposal Piles.

181. **HYDROLOGY** (45). The reader is referred to Chapter IV, Hydrology, Mine Dewatering for an explanation of Figure IV-8.

182. **WILDLIFE** - Mitigation (45). Employee busing is stated as an assumption in Chapter IV, Transportation.

183. **WILDLIFE** - Methodology (45). Estimates were derived using methodology described by Lyon (1979) for determining loss of effective habitat. This process did not involve statistical analysis and therefore no confidence limits were established.

184. **VEGETATION** - Surface disturbance (45). Table IV-7 is the first place in the text where this information is presented. Footnote 1 explains that not all of the acreage would be impacted or would be out of production at any one time.

185. **LEASE** - Environmental stipulations (46, 46c). Oil Shale Lease Environmental Stipulation Section 4 (B) mandates the development of a habitat management plan which is essentially identical to the referenced Green River - Hams Fork wildlife stipulation.

186. **MINIMUM ACCEPTABLE BID** (46). The criteria for establishing a minimum acceptable bid were published for public review and comment in the Federal Register on October 20, 1982.

187. **SURFACE RECLAMATION** - Irrigation (46b). Irrigation is an established reclamation procedure, especially if reclamation is to take place directly on spent shale. However, your comment is

valid in that longer term studies are needed to confirm that this is a good method to use, especially for various retort methods and its effects on the spent shale.

**188. SURFACE RECLAMATION** - Disposal piles (46b). Depending on the disposal pile design, lower zones of the pile may receive the same compactive effort as the final surface of the pile. If this is the case then the lower zones may be consolidated to the same extent as the surface resulting in a relatively consistent permeability. However, pile design will be established at the time the Detailed Development Plan is accepted and finalized as a result of the design studies that would be conducted on the first few commercial scale disposal piles created by an oil shale facility.

Concerning evapotransporation, appropriate changes have been made to the text.

**189. SURFACE RECLAMATION** - Shale disposal (46b). In Chapter IV, Surface Reclamation, the fourth paragraph under the Aboveground Shale Disposal section states that capillary barriers have only been conducted on small test plots over a short time period which may not adequately reflect long-term environmental conditions.

**190. HYDROLOGY** - Mine dewatering (46b). Because it is not known what practices would actually be taken by Tract C-a and C-b to dispose of excess dewatering water, a worst case analysis was made. The impacts identified for Yellow Creek agree with the analysis done by Tract C-a.

**191. SURFACE RECLAMATION** - Mitigation (46b). The mitigation measure you suggest is discussed in Chapter IV, Surface Reclamation and Solid Waste Disposal.

**192. WILDLIFE** - Mitigation (46, 46c). The firearm and employee transportation measures listed as uncommitted mitigation have been incorporated as lease stipulations. However, BLM can not require, only recommend that a company participates in an industrial association. Therefore, this will remain as uncommitted mitigation.

**193. CULTURAL RESOURCES** - Consultation (46h). Consultation with the SHPO on the eligibility of the cultural resource sites located on Tracts C-11 and C-18 has been undertaken and is currently in progress.

**194. CULTURAL RESOURCES** - Model (46h). A copy of the Gilbert/Commonwealth study is available from the BLM office in Meeker at your request and can be sent to you after the report has been formally accepted by the BLM.

**195. CULTURAL RESOURCES** - Lease Stipulations (46h). Section 6, Part A(1) of the Environmental Stipulations of the lease states, in part, that "Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource field inventory in a manner specified by the Mining Supervisor on portions of the area that may be adversely affected by lease-related activities and which were not previously inventoried".

**196. AIR QUALITY** - Model (47, 48). Comparisons of TAPAS modeling results to EPA guideline model results have been performed and are presented in the supplemental impact analysis technical report (Dietrich et al 1982b). The BLM and the U.S. Forest Service have been cooperatively developing the TAPAS modeling system for routine analysis of potential air quality impacts in applicable situations for several years. Several presentations have been made in technical forums outlining the approach and progress towards implementation. Regarding the prototype analysis, a technical review meeting was held April 29, 1982 where the modeling approach was detailed to representatives of State and Federal regulatory agencies and other land management agencies. No objections were received at that time.

It is presumptuous to guess whether regulatory agencies would utilize TAPAS in their impact analyses, but in one specific application, the EPA has given preliminary approval to use a similar model (MESOPUFF) for evaluating PSD permit applications. The application of non-guideline models for PSD permit evaluations must be approved by the EPA on a case specific basis (47 Federal Register 42806). Internally, EPA personnel have been examining the application of guideline models with modeled wind field trajectories.

**197. HYDROLOGY** - Water rights (48). Conditional water rights may or may not be developed in the future. Whether or not development of these conditional water rights will ever take place will depend upon many variables, the analysis of which is far beyond the scope of this EIS. The economics of the industry may dictate that none of the conditional rights be developed, or all the wells but one. The situation increases in complexity when all the other variables affecting the development of conditional rights are considered.

**198. EXISTING RIGHTS** - Public water reserves (48). A description and the location of the public water reserves on the tracts is included in Chapter III, Existing Rights. Specific locations of springs, wells and public water reserves are not required for the modeling analysis.

**199. HYDROLOGY** - Surface flow (48, 50). The 1951 base period is the hydrologic time period which is being used by the U.S. Bureau of Reclamation in their modeling efforts to simulate a

normal hydrologic period. See the reference (Bureau of Reclamation 1981) cited in this text for further information.

**200. ECONOMICS** - Assumptions (48). Primary employment (for both the construction and operation phases on the lease tracts) was determined as part of the lease assumptions. Secondary employment estimates were obtained by means of an economic model. Both types of employment were allocated to communities as shown in the second table below.

The following assumptions were used for primary employment on the proposed lease tracts:

| Primary Employment | One Tract | | Both Tracts | |
|---|---|---|---|---|
| | Construction | Operation | Construction | Operation |
| **Low Scenario** | | | | |
| 1988 | 1,700 | 188 | 3,400 | 376 |
| 1993 | 0 | 1,125 | 0 | 2,250 |
| **High Scenario** | | | | |
| 1988 | 2,200 | 233 | 4,400 | 466 |
| 1993 | 0 | 1,400 | 0 | 2,800 |

As can be seen, the projection for both tracts double that for a single tract. Differences between Tracts C-11 and C-18 in the text arise from the sodium operation on part of C-18 which is assumed to continue if that tract were not leased.

Community Allocations

(percent)

| | Primary | | Secondary |
|---|---|---|---|
| | Construction | Operation | (Pct. of County) |
| Glenwood-Carbondale | 0 | 0 | 18 |
| New Castle-Silt | 3 | 2.7 | 0 |
| Parachute-Battlement Mesa | 2 | 1.8 | 0 |
| Rifle | 55 | 50.0 | 82 |
| Grand Junction | 0 | 7.3 | 100 |
| Meeker | 33 | 30.9 | 81 |
| Rangely | 7 | 7.3 | 19 |

The same allocation was used for all tract combinations and scenarios. As noted above, primary allocations were based on data for the other oil shale projects. Secondary allocations were based on retail sales data and tract locations.

Garfield, Mesa and Rio Blanco Counties compose the impacted area, and include the communities of Carbondale, Glenwood Springs, New Castle, Silt, Rifle, Parachute, Battlement Mesa, Grand Junction, Meeker and Rangely. Rifle and Meeker would be most heavily impacted by the proposed leasing, and some sections of the report may concentrate on them. See the table above for community allocation proportions.

The criterion for establishing the limits of expected social impacts was the population distribution predicted by the model uses. Those communities expected to gain population were included in Chapter III, Social. This point has been clarified by a minor wording change in the text. Seven communities were predicted to draw population.

The "inconsistencies" noted by the commenter grow out of the fact that different alternatives were being discussed in each case, and only those communities pertinent to each alternative are addressed, from the total potential group of seven.

Economic impact rankings were based on population and employment growth as compared to the baseline (No Action Alternative). As stated in Chapter IV, Economics, these were not related to a fixed set of percentage standards. Impacts on community facilities and services were not estimated in the Draft EIS, because sufficient data had not been acquired, but that data is now available and those estimates have been included in the Final EIS.

**201. GENERAL** - Analysis methodology (48). Admittedly, there is a wide diversity of opinion on the proper methodology for preparing an environmental impact statement. Where possible throughout the document, impacts were quantified and the significance judged based on the importance they should play for the decision-maker in reaching a final decision. In any case, guidelines developed by the Council on Environmental Quality in implementing NEPA were the major source of guidance for the EIS team. Where desirable or practical, additional clarifying methods were used to present the information. The important thing is that the EIS is successful in presenting to the decision-maker and the public the effects on the environment of implementing each alternative. The commenter concedes that this document has met this goal, stating "the impacts for each alternative were easily understood".

**202. AGRICULTURAL LANDS** (48). Factors used to evaluate significance of agricultural land impacts were: (1) quality of lands impacted, (2) acreage impacted, (3) percentage of county impacted, (4) distribution of impacts, and (5) recommendations from Colorado Department of Agriculture.

**203. VEGETATION** - Impact analysis (48). For the purposes of worst case analysis, it was assumed that the most productive forage lands would be impacted. This was done so that all possible impacts would be discussed. However, the amount,

type and timing of impacts would differ by development scenario. This is shown in tabular form in Chapter IV, Vegetation, in both the Vegetative Types section and the Grazing section, and explained in the Grazing section narrative. While different specialists don't agree on all aspects of revegetation, it is felt that this subject was discussed adequately. The assumptions made in Chapter IV, Vegetation, Grazing on water table drawdown are consistent with those made in Chapter IV, Hydrology, Groundwater Quantity - Impacts to Existing Sources.

**204. WILDLIFE** - Secondary impacts (48). Data and methodology are not available to further quantify secondary off-tract impacts from recreational activities.

**205. VISUAL RESOURCES** - Methodology (48). The methodology used to describe the existing visual resource is not outdated. The visual resource inventory was conducted according to current BLM Visual Resource Management procedures. However, the description in Chapter III was incomplete as the Management Classes were not included. The text in both Chapters III and IV has been changed accordingly.

**206. GEOLOGY** - Open pit mining (48). The front end investment is determined by the magnitude and timing of the initial costs of production. In the case of removing 1000 feet of overburden prior to production of any oil shale, the "front end investment" would be prohibitively high given current and foreseeable future economic conditions. These economic facts, coupled with current laws limiting the size of lease tracts effectively preclude surface mining of deeply buried deposits having favorable stripping ratios.

**207. SURFACE RECLAMATION** - Compaction (48). Leaving an uncompacted, but leached upper three to four feet of spent shale may be conducive to plant growth in addition to a topsoil mantle. No studies have been done on this type of design. However, a conclusion could be made that this layer would require intensive fertilization and leaching (to be conducive to plant root growth) similar to that of revegetation efforts directly on spent shale. Whether leaching of spent shale prior to placement is impractical or not is a matter of opinion and long-term waste control designs.

**208. SURFACE RECLAMATION** - Erosion (48). In arid regions of the west, there is rarely a situation where soil formation under natural conditions is greater than soil erosion. "Erosion is a natural process. Thus soil cover or spent shale modified for plant growth will eventually erode, particularly from steep upper slopes. This eventuality must be considered and addressed in future waste stabilization research and planning" (Harbert and Berg 1978). The factors listed could possibly reduce soil erosion rates, but not present exposure of spent shale over the long-term.

**209. LEASE** - Preamble (48). The subject clause has been deleted from the preamble of the lease.

**210. LEASE** (48). This is within the discretionary authority of the Secretary of Interior.

**211. LEASE** - Detailed development plan (48). Three years for preparation of the Detailed Development Plan has not proven to be burdensome or unrealistic for the first prototype lessees. Based on this past experience, this should not prove to be a problem for any future prototype lessees.

**212. CULTURAL RESOURCES** - Standard stipulations (48). Actions on public lands outside the lease boundaries are subject to the standard BLM permitting process which would require a Class III cultural resource inventory on all proposed areas of disturbance located on public surface.

**213. LEASE** - Environmental Stipulations (48). The referenced stipulation does not say that daily movement patterns of fauna must be documented. The stipulation states that fauna studies will determine daily and seasonal movement patterns. This does not require "daily year round fauna monitoring" as the commenter suggests.

**214. AIR QUALITY** - Model (49). Due to the preliminary nature of the proposed action, near source air quality impact analysis is inappropriate. General consideration of relative impacts between both tracts can be made qualitatively; but quantitative analysis without site specific input information (i.e., site location, mining and retort processes, control technology, local meteorologic inventory, etc.), would be meaningless. Detailed near source impact analysis would be required in a subsequent evaluation of the detailed development plan if a lease is issued. For the same reason, a long-range transport/regional bias was intentional in the worst-case analysis performed.

**215. AIR QUALITY** - Acid deposition (49). The Final EIS presents estimates of the acid deposition pattern over the Flat Tops and Mount Zirkel Wilderness Areas. The appropriate ratio between 24-hour worst-case and annual deposition is a matter of speculation since no credible data is available in this region. Monitoring is being conducted which will help establish such data. Ranges of predicted values are presented based on impacts from additional prototype lease tract development only and the culmulative (all point source) scenarios. These are detailed in the supplemental impact analysis technical report (Dietrich et al 1982b).

**216. SOCIOECONOMICS** (49). The percentages shown in Tables IV-19 and IV-20 are based on pop-

ulation numbers in Appendix B, Tables B-1 to B-5. The heading for Table IV-19 has been modified to clarify this fact. Employment, income, housing, agricultural and community revenue impacts are given in Tables IV-21 through IV-24.

The magnitude of social impacts are "quantified" at the top of Table IV-20 so that readers know precisely how the terms were defined by the author, but the attachment of percentages to the level of predicted "severity" is judgemental and readers are free to distribute percentages differently.

The commenter's remark about the use of "anecdotal" data is confusing. The text statement regarding professional planners is illustrative of the trend, not anecdotal.

**217. SURFACE RECLAMATION** - Compaction (49). Compaction is only a part of a waste disposal system and is not intended to be the only design criteria. That is why other sections dealing with retort conditions, location of spent shale piles, cementation, alkalinity and toxicity are discussed. Also included in the text are "unique properties of retorted shale" which need to be considered in the design of spent shale wastes.

**218. SURFACE RECLAMATION** - Compaction (49). One hundred percent compaction is supported by Bloomfield and Stewart (1981) in both field tests and laboratory tests. Field test utilized conventional equipment to compact eight and twelve inch loss layers of spent shale successively and obtained as much as 108 percent of laboratory compaction. Parameters such as permeability, seepage, leachates and stability are derived mostly from their laboratory tests.

**219. SURFACE RECLAMATION** - Leachates (49, 50). Due to the level of saturation and the location of a spent shale disposal pile, internal drains, check dams and lined basins may become necessary to catch initial leachates (if any) from the pile. These types of structures are available for use through the lease stipulations until it is proven they are not necessary to prevent an undesirable rate of release of leachates into the natural environment. Clarification has been added to the text.

**220. SURFACE RECLAMATION** - Revegetation (49). Although carbonized shales can be treated to allow for vegetative growth, it is felt that there will be a continual problem with toxic elements being either leached or taken up in the plant growth that is established, specifically boron and fluorine. To say that there would be no problems with carbonized shales if proper treatment occurs would be misleading.

**221. HYDROLOGY** - Model (50). It is difficult to compare model results with the dewatering results done at C-b to analyze changes in TDS for the following reasons:

1. The model predicted pumping rates of 15 cubic feet per second, five times that of C-b.
2. The model predicted TDS levels after 30 years and with no reinjection. C-b has been pumping for only three years and has done reinjection in March of 1981.

In addition, there was only one water quality sample taken in 1981 because of reinjection. The 1980 results indicated that there was not a linear trend in TDS, but there was a negative trend from wells WY-61 and WY-62 for specific conductance.

**222. LEASE** - Monitoring (50). Section 1(C)(2)(b) of the lease does not say that deep aquifer wells are necessary for raw or spent shale disposal sites. Depths and location of the monitoring wells are to be specified by the Mining Supervisor.

**223. AIR QUALITY** - Legal Requirements (53). Legislative mandates require BLM to analyze potential impacts on air quality from proposed alternatives, and to identify preferred alternatives based on an interdisciplinary assessment of anticipated impacts.

These requirements will continue to compel lessees to conduct their operations in full compliance with all laws, including air pollution regulations. In situations where exceedance of air quality standards have been predicted, and it is reasonable to believe that the situation can be mitigated to comply with quality regulations, potential lessees would be informed of the situation and leases may be issued. The options identified by the commenter should then be considered by the lessee and the appropriate regulatory agency.

**224. HYDROLOGY** (53). The discussion of cumulative impacts was done for both surface and groundwater in the Draft EIS. The cumulative impacts resulting from discharges similar to that from C-b should not be allowed to occur and are controlled by the State through the issuance of NPDES permits.

**225. HYDROLOGY** (53). It is assumed that the commenter is referring to C-a and C-b, not U-a and U-b. U-a and U-b are in the early phase of construction. The performance history of both C-a and C-b were examined and discussed in the Draft EIS. Reinjection comparisons are not valid because of the very different groundwater systems; C-a and C-b are located near areas of recharge, whereas C-11 and C-18 are near areas of discharge. The proximity to the stream channels of both C-11 and C-18 are different than C-a and C-b. Regulation of surface water discharges are done by the state through issuance of NPDES permits.

**226. HYDROLOGY** (53). Again, it is assumed that the commenter is referring to C-a and C-b rather than U-a and U-b. The entire document, the lease and environmental stipulations have considered past experiences on the existing prototype leases.

**227. GENERAL** - Affected environment (D). Chapter III, the Affected Environment, describes the resources and geographic area where significant impacts can be predicted. Where the impacts are not felt to be significant, or where they are too dispersed to be predicted, they have not been addressed in detail.

**228. SOCIAL** - Impact severity (M). Researchers on boom town growth vary widely on their estimates of severity of social impacts associated with that growth. Judgments generally range from 5 to 15 percent annual growth as the point where "severe" impacts begin to occur. We have been more conservative than usual in this EIS because all the affected communities will presumably already have experienced enough growth that individuals, social structures and attitudes will have reached a fairly high level of preparedness.

Suggestions for mitigation funding are contained in the section in Chapter IV having to do with mitigations not legally required by BLM.

**229. SOCIAL** - School capacities (M). According to an official in the Rangely School District, as of October 7, 1982, there existed an excess capacity in the elementary school (K-5) of 80, and in the high school (9-12) of 150-175. The junior high was overcrowded with some use of temporary facilities required. A new junior high school is under construction.

**230. SOCIAL** (M). The advisory groups mentioned are "official". Both Rio Blanco and Garfield Counties have Human Services Councils made up of representatives from the various social service delivery systems, including social welfare, colleges, mental health, handicapped, elderly, education and other organizations. In addition there is a Human Resources Council for the whole western slope which meets periodically. Rio Blanco County also has an Advisory Council (divided into east and west for Meeker and Rangely) which was set up by the County and which includes representatives from all four levels of government, business and industry, churches, schools, etc., and whose regular meetings are open to the public. All of these groups are concerned with social and economic impacts of energy development, funding sources and decisions, assessment of needs, and establishment of priorities.

Under current Office of Management and Budget regulations, BLM may not conduct the in-depth social surveys recommended by the commenter without special clearance.

**231. SOCIAL** - Winners/losers (M). It is not possible to quantify (in terms of head counts) or specify just which persons would "win" or "lose" during the boom and restabilization period. The text attempts to spell out the kinds of persons, and the types of gains and losses they would most likely experience in the human sense (based on empirical evidence). It also lists sources of fluctuations in severity of these elements.

These negative and positive social (and economic) impacts, and the trade-offs among them, are considered -- along with the negative and positive factors in the various other environmental resource elements -- in the decision for which this EIS is prepared.

**232. HYDROLOGY** - Water rights (G). A water right is the same as a property right in the State of Colorado. Without some form of condemnation process, an oil shale company cannot "commandeer" agricultural water rights and can only obtain the water right if the owner chooses to sell it. The Colorado State Constitution contains a condemnation process for water rights based on priority; first priority is domestic use, second is agricultural, third is industrial, etc.

**233. HYDROLOGY** - Water rights (G). The guarantee made by Arco to the farmers in Paonia is voluntary. Existing water right holders within the Piceance Basin are protected under Colorado State Law.

**234. ECONOMICS** - Diligence (G). BLM has no legal power to require completion of projects on leased Federal land, except to terminate leases that are not carried out in accordance with the diligent development provisions. The uncertainty inherent in future markets would make such a requirement economically infeasible and legally unenforceable.

**235. LAND USE PLANNING** (G). Coordination with county and city governments is recommended in this EIS. Land use plans implemented by these agencies can be developed to minimize impact to farm lands, grazing lands, and agricultural lands from urban development.

**236. LEASE** - Environmental Stipulations (G). The commenter is referred to Section 12(d) of the Prototype Oil Shale Lease, and Section 9(A) of the Environmental Stipulations of the lease. In addition, several protections are included in the Environmental Stipulations of the lease for groundwater contamination.

**237. ECONOMICS** - Rapid growth (G). Rapid growth in a local area usually aggravates local infla-

tion in housing, retail goods, and services by creating a sudden increase in demand. However, it can also have the opposite effect by encouraging new competitors to enter the market. Because statistics are not collected on inflation rates in small communities, there cannot be any quantitative projections made of such impacts and it can only be stated as in the Draft EIS, that they would be likely to occur.

An addition has been made to the text to clarify the point about vulnerable groups in the population.

**238. ECONOMICS** - Revenues (G). Although estimates of the actual amounts of additional property and severance tax revenues are not presently possible, oil shale development would certainly generate them. Additional revenues would accrue to the federal government through royalty and bonus payments, the state government through severance taxes, and local governments through property and sales taxes -- both direct and induced -- and returned portions of the first two. However, boom town experience in Colorado and elsewhere has shown that the capital improvement costs required by large population growth greatly exceed the additions to local revenues, particularly in the early years of growth when the improvements must be built.

**239. NET ENERGY ANALYSIS** (G). The boundaries of the net energy analysis were drawn to exclude resources left in the ground. The rationale for this methodology is that we are attempting to describe, in a quantitative manner, the energy needed to produce another energy, oil shale. The purpose of the analysis was to determine, by type and quantity, what direct and indirect energy sources must be devoted to oil shale production. Therefore, the resources left in the ground were not taken into consideration because they are not energy used to produce oil shale.

**240. GENERAL** (G). It is not within the authority of the Department of the Interior to establish electricity rates.

**241. NET ENERGY ANALYSIS** (G). The Draft EIS states that electricity has less utility, as an energy type, than does oil. This statement was made to indicate the differences in energy qualities. Electricity may be considered a premium energy by some because of its economic and environmental costs. However, energy analysts consider oil to be a higher quality energy form because it is more easily transported and stored than electricity and it also has more utility.

The Draft EIS also stated that it was unclear whether or not excess generating capacity was available within the Western Area Power Administration region. However, even if there is no excess generating capacity, the Deseret Generation and Transmission Cooperative (Moon Lake Power Plant) could opt to build a second generating unit to furnish power for the oil shale industry. Moon Lake Power Plant has already had an EIS written for it -- May 1981, BLM/REA. REA has stated that they will require further environmental analysis if and when a second unit is required. A second potential source for electricity is Colorado Ute's proposed Southwest Generating Station.

It should be noted here that any new generating stations getting loans from REA or rights-of-way from BLM will be required to have an environmental analysis completed before grants are issued. The concerns listed in the comment would be addressed in the analyses.

**242. AGRICULTURAL LANDS** - Urban conversion (G). Both the Colorado Department of Health and the State Department of Agriculture have studied the effect of conversion of agricultural land from urban development. Daily Sentinel reporters have recently performed literature reviews and information searches to base newspaper articles documenting this impact in Mesa County. Also, refer to Chapter IV, Agricultural Lands for discussion of impacts estimated for urban development on croplands associated with this project.

**243. HYDROLOGY** - Scope (G). The specific impacts to ground and surface waters cannot be fully analyzed until a Detail Development Plan is submitted (after the tract is leased). At that time, a specific process would be proposed and would be analyzed for impacts to surface and groundwaters.

**244. HYDROLOGY** - Water use (G). Water for stock ponds is primarily derived from snow melt or excess runoff from thunderstorms and will not be affected by groundwater pumping. The Draft EIS further states that wells and springs within the area identified in Figure IV-9 should be monitored for impacts, and that mitigation for lost sources will be done. The text has been clarified as appropriate.

**245. HYDROLOGY** - Groundwater (G). The Draft EIS states that water might have to be treated for domestic or stock use in the long-term. It further presents mitigating measures to reduce groundwater quality impacts. Because impacts may not show up for hundreds of years, a monitoring program is recommended.

**246. HYDROLOGY** - Augmentation (G). Most streams within the state are over appropriated, thus the state requires an augmentation plan for any major water diverted by a junior appropriator to protect senior water right holders.

**247. AIR QUALITY** - Comparison with other analyses (39, 40, 47, 49, 50). Due to the preliminary nature of a draft analysis, it is not appropriate to

compare predicted pollutant concentration values until a final EIS is prepared. There are no longer any large discrepancies with other modeling studies due to improvements in the modeling approach utilized for the Prototype Final EIS, but whenever different modeling approaches or varying assumptions are applied, there will be a variation between reported results. Modeling approaches and assumptions are made on a case-by-case basis, reflecting varying levels of available information and/or the state-of-the-art of the models applied. A comparison of the final results for the studies mentioned above indicates nearly identical results within the limitations of varying modeling approaches and assumptions applied. A detailed analysis of these differences is available upon request from the BLM Air Quality Specialists in Colorado and Utah.

**248. AIR QUALITY** - Model (22, 40). The BLM has no "second thoughts" about the modeling approach utilized to predict air quality impacts associated with alternatives for leasing additional prototype oil shale tracts. The modeling selection and application criteria are elaborated at length in the impact analysis technical report (Dietrich et al 1982a), and summarized below. The air quality analysis presented in the EIS was performed to satisfy requirements of NEPA. It should not be interpreted in a regulatory sense and would not satisfy the requirements of the regulatory process under the Clean Air Act.

Since there is no EPA approved/verified air quality model applicable for analysis in complex terrain or on a regional scale (as encountered in Western Colorado), a modeling approach was selected which applied best scientific and professional judgment to make adequate assessments within limitations of available information. TAPAS was selected because: it is applicable in complex terrain; it can model multiple emission sources; it utilizes terrain induced pollutant trajectories; it is suitable for the regional scale (50-200 km transport distances); it is applicable for worst-case analysis; and similar versions of the models have been applied by regulatory agencies in specific situations (47 FR 42806).

Because best modeling approaches must be selected on a case-by-case basis, and atmospheric dispersion modeling is an evolving art, it is unreasonable to expect one model to be applicable for all of BLM's needs.

**249. HYDROLOGY** - Leachate transport (32, 48). Long-term dissolved solids concentrations may increase. It is difficult at this time to ascertain the long-term effects due to the unknown extent of actual aquifer fracturing in the lease tract areas, the rate of release of solids from the mine areas, and the amount of dilution dissolved solids would undergo prior to reaching surface streams. Please refer to Chapter IV, Hydrology, Groundwater Quality, Leachates of Subsurface Retort Chambers section concerning the rate of leachate transport.

**250. HYDROLOGY** - Groundwater (53). Solution mining in the saline zone would have to be developed to leave a sufficient boundary layer between the bottom of the lower aquifer and the solution cavity to prevent inflow or subsidence. Even if subsidence should occur, the effects upon groundwater flow is expected to be insignificant due to the fact that the Piceance Basin aquifer flow is fracture controlled.

**251. HYDROLOGY** - Alluvial flows (51). Although there are clay lenses that provide impeded alluvial flow; the alluvial flows are assumed to be derived from the bedrock aquifers as used in the model for groundwater impacts. The commenter is refered to Taylor (1982) for further clarification of model assumptions.

**252. HYDROLOGY** - Mitigation (45). The commenter is urged to read the beginning of Chapter IV, Hydrology concerning modeling results and Chapter II, C-11 Alternative, Hydrology section concerning water augmentation.

**253. HYDROLOGY** - Salinity (G). BLM's modeling results do not agree with the referenced report. If increased salt loads did occur, such high levels of salts would require mitigation (in essence, treated) prior to release into the stream system. The text has not been changed.

**254. HYDROLOGY** - Groundwater (48). This data was obtained from Weeks et al (1974). Provision of additional rationale or ranges of data would not significantly add to the analysis.

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